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ILMENITE AND RUTILE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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India is endowed with large resources of heavy minerals which occur mainly along coastal stretches of the country and also in inland placers. Heavy mineral sands comprise a group of seven minerals, viz, ilmenite, leucoxene (brown ilmenite), rutile, zircon, sillimanite, garnet and monazite. Ilmenite ($FeO.TiO_2$) and rutile (TiO_2) are the two chief minerals of titanium. Titanium dioxide occurs in polymorphic forms as rutile, anatase (octahedrite) and brookite. Though, Brookite is not found on a large-scale in nature, it is an alteration product of other titanium minerals. Leucoxene is an alteration product of ilmenite and found associated with ilmenite.

RESOURCES

Ilmenite and rutile along with other heavy minerals are important constituents of beach sand deposits found right from Ratnagiri coast (Maharashtra) in the west to Odisha coast in the east. These minerals are concentrated in five well defined zones:

* Over a stretch of 22 km between Neendakara and Kayamkulam, Kollam district, Kerala (known as 'Chavara' deposit after the main mining centre).
* Over a stretch of 6 km from the mouth of Valliyar river to Colachal, Manavalakurichi and little beyond in Kanyakumari district, Tamil Nadu (known as MK deposit).
* On Chatrapur coast stretching for 18 km between Rushikulya river mouth and Gopalpur lighthouse with an average width of 1.4 km in Ganjam district, Odisha (known as 'OSCOM' deposit after IREL's Orissa Sands Complex).
* Brahmagiri deposit stretches over 30 km from Girala nala to Bhabunia villages with an average width of 1.91 km in Puri district, Odisha.
* Bhavanapadu coast between Nilarevu and Sandipeta with 25 km length and 700 m average width in Srikakulam district, Andhra Pradesh.

The AMD of the Department of Atomic Energy has been carrying out exploration of these mineral deposits. So far, about 3,703 km coastal tract and 160.72 sq km in the inland areas in Tamil Nadu and West Bengal have been investigated for over six decades by AMD. The ilmenite resource estimation for the areas explored up to 2009 has been almost completed and the resources are up from 461.37 million tonnes to 520.38 million tonnes (including leucoxene), inclusive of indicated, inferred and speculative categories. Resource estimation for the areas explored during 2009-12 is under progress. The most significant deposits which are readily available and attract attention of industry for large-scale operations are as follows:

State/Deposit	Ilmenite reserve (In million tonnes)
Andhra Pradesh	
1. Amalapuram	8.05
2. Bhavanapadu Hukumpet	10.18
3. Kakinada (Phase I-VII)	13.84
4. Kalingapatnam	5.80
5. Narasapur	2.92
6. Nizampatnam	19.26
7. Srikurman (South)	8.60
8. Visakhapatnam (Bhimunipatnam)	2.88
Kerala	
1. Chavara	13.00
2. Chavara Eastern Extension	17.00
3. Chavara (Phase II)	49.00
Maharashtra	
Ratnagiri	3.68
Odisha	
1. Brahmagiri	37.98
2. Chatrapur	26.72
Tamil Nadu	
1. Kudiraimozhi	23.00
2. Navaladi-Periatalai-Manapadu	24.00
3. Sattankulam	41.26

Source: *Department of Atomic Energy, Mumbai.*

Table – 1 : Resources of Ilmenite and Rutile

(In million tonnes)

State	Total in situ #
Ilmenite* : Total	**520.38**
Andhra Pradesh	171.04
Bihar	0.73
Kerala	117.52
Maharashtra	3.74
Odisha	108.23
Tamil Nadu	117.07
West Bengal	2.05
Rutile : Total	**29.11**
Andhra Pradesh	10.30
Bihar	0.01
Kerala	7.24
Odisha	6.06
Tamil Nadu	5.31
West Bengal	0.19

Source: *Department of Atomic Energy, Mumbai.*
 # Inclusive of indicated, inferred and speculative categories.
** Including leucoxene.*

The average grade of total heavy minerals in these deposits is 10-25% of which 30-35% is ilmenite. The overall statewise reserves of ilmenite and rutile which occur together in beach sand deposits are given in Table-1.

As per the UNFC system as on 1.4.2010 compiled by the National Mineral Inventory (NMI) Unit of IBM, the total resources of titanium minerals is placed at 394 million tonnes comprising ilmenite (335.6 million tonnes), rutile (13.4 million tonnes), leucoxene (1.0 million tonnes), anatase (3.3 million tonnes) and titaniferous magnetite (40.6 million tonnes).

EXPLORATION & DEVELOPMENT

GSI carried out placer mineral investigations within the territorial waters off north of Bhimunipatanam, Andhra Pradsh . The approximate total heavy mineral resource estimated is 1.69 million tonnes of the total sand in 47.23 million tonnes at surface level; 1.42 million tonnes of heavy minerals in the total sand of 37.42 million tonnes at 0.5-1 m level; 0.72 million tonnes of heavy minerals in total sand of 20.25 million tonnes at 1.00-1.50 m level in the same area.

GSI carried out reconnaissance survey for preliminary appraisal of heavy mineral occurrence along Daman-Dandi Coast, Gujarat. They found small quantities of magnetite and ilmenite in the sediments on the left bank of Puma river, in the Dandi beach.

Directorate of Geology, Odisha took up investigation during 2011-12 for heavy minerals (ilmenite, rutile, garnet, sillimanite, monazite, etc.) in beach sands, Balarampur area in Puri district. Mapping over 0.92 sq km area on 1:2,000 scale was conducted along with 2280 auger drilling and collection of 2000 number of samples during the year. Four potential heavy minerals bearing areas around Gelinasi, Hunda-Samantaraipur, Mulpari and Mundabar areas have been identified. The estimated total heavy mineral concentration in Hunda-Samantaraipur and Mulpari areas was 3 to 17.09 percent.

The survey and exploration carried out by AMD during 2008-09, 2009-10, 2010-11 and 2011-12 included parts of West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra and Gujarat. The details of exploration activities carried out by AMD during 2011-12 are furnished in Table-2.

PRODUCTION AND PRICES

Ilmenite

The production of ilmenite at 751 thousand tonnes in 2011-12 increased by 13% as compared to that in the preceding year. Tamil Nadu was the leading producer of ilmenite during the year under review, contributing 63% of the total production followed by Odisha 25% and Kerala 12 percent.

Table – 2 : Exploration Activities by AMD for Ilmenite, Rutile, Monazite, Zircon and other Heavy Minerals, 2011-12

Location	Activity		Results
	Reconnai-ssance survey (sq km)	Detailed survey (sq km)	
Parts of West Bengal, Odisha, Andhra Pradesh, Karnataka and Tamil Nadu	200 (Coastal tracts) Inland areas	12.20	Reconnaissance survey was undertaken to delineate potential heavy mineral concentrations along the coastal and inland tracts: (a) The coastal tract between Gundlakamma and Musi rivers, district Prakasam, Andhra Pradesh records 5-8% THM in the surficial layers. (b) The coastal tract between Rayadoruvu and Swarnamukhi river-mouth, district Nellore, Andhra Pradesh indicates HM concentration of 5-15% along the berm zone. (c) NW extension area of Brahmagiri mineral sand deposit, district Puri, Odisha records THM concentration of 8-10%. (d) Inland paleo placers of Depal-Kanthi tract, district Midnapore, West Bengal records THM concentration of 4%. (e) The coastal sector between Manamelhudi and districts Thondi, Pudukkottai and Ramanathapuram, Tamil Nadu. HM records concentration of 1-8%. (f) Beach placers of Kaup-Udupi-Koni-Kundapura, district Udupi, Karnataka records HM concentration varies from 3 to 8%. In addition to reconnaissance surveys, detailed survey was carried out in Malikipuram deposit, district East Godavari, Andhra Pradesh to upgrade the resources from inferred to indicated category. Further work is in progress.

***Source**: Department of Atomic Energy, Mumbai.*

Rutile

The production of rutile at 17 thousand tonnes in 2011-12 decreased by 37% as compared to that in the previous year. Odisha was the leading producer of rutile accounting for 47% of the total production followed by Kerala 34% and Tamil Nadu 19 percent.

Production and prices of ilmenite and rutile are furnished in Tables - 3 to 5.

Table – 3: Production of Ilmenite and Rutile 2009-10 to 2011-12 (By States)

(In tonnes)

State	2009-10	2010-11(R)	2011-12 (P)
ILMENITE			
India : Total	**713605**	**663217**	**751163**
Kerala	133832	113240	86454
Odisha	210031	206139	188000
Tamil Nadu	369742	343838	476709
RUTILE			
India : Total	**18573**	**26593**	**16598**
Kerala	6607	5969	5664
Odisha	8033	8043	7874
Tamil Nadu	3933	12581	3060

Table – 4 : Prices of Rutile, 2009-10 to 2011-12

(₹ per tonne)

Year	Grade	Price	Remarks
IREL			
2009-10			
(w.e.f. 7.4.2009)	Q/MK/OR	41000	Ex-works, bagged
2010-11			
(w.e.f. 1.4.2010)	Q/MK/OR	41000	Ex-works, bagged
(w.e.f. 1.5.2010)	Q/MK/OR	35000	Ex-works, bagged
(w.e.f. 11.2.2011)	Q/MK/OR	37500	Ex-works, bagged
2011-12			
(w.e.f. 1.4.2011)	Q/MK/OR	37500	Ex-works, bagged
(w.e.f. 6.4.2011)	Q/MK/OR	40000	Ex-works, bagged
(w.e.f. 26.5.2011)	Q/MK/OR	53000	Ex-works, bagged
(w.e.f. 8.6.2011)	Q/MK/OR	61500	Ex-works, bagged
(w.e.f. 5.7.2011)	Q/MK/OR	80000	Ex-works, bagged
(w.e.f. 1.8.2011)	Q/MK/OR	98000	Ex-works, bagged
(w.e.f. 1.3.2012)	Q/MK/OR	109000	Ex-works, bagged
KMML			
2009-10	94.85% TiO_2	37000 to 41000	–
2010-11	92% (min)	33000 to 41000	–
2011-12	92% (min)	40000 to 109000	–
V.V. Mineral (Average)			
2009-10	NA	34475	Average
2010-11	NA	37565	Average
2011-12	Premium & Standard	70610	Average

Source: *Department of Atomic Energy, Mumbai.*
Note*: Q : Quilon; MK: Manavalakurichi; OR: Odisha.*

Table – 5: Prices of Ilmenite, 2009-10 to 2011-12

(₹ per tonne)

Period	Grade	Price	Remarks
IREL			
w.e.f. 7.4..2009	Q	4700	Ex-works, loose
	MK	4450	Ex-works, loose
	OR	5000	For Non SR/TiO_2 producers
	OR	4000	For SR/TiO_2 producers
w.e.f. 1.4.2010	Q	4700	Ex-works, loose
	MK	4450	Ex-works, loose
	OR	5000	For Non SR/TiO_2 producers
	OR	4000	For SR/TiO_2 producers
w.e.f. 1.5.2010	Q	6000	Ex-works, loose
	MK	5000	Ex-works, loose
	OR	4000	For SR/TiO_2 producers
	OR	5000	For Non SR/TiO_2 producers
w.e.f. 2.6.2010	Q	5300	Ex-works, loose
	MK	5000	Ex-works, loose
	OR	6000	For Non SR/TiO_2 producers
	OR	4000	For SR/TiO_2 producers
w.e.f. 11.2.2011	Q	5700	Ex-works, loose
	MK	5400	Ex-works, loose
	OR	4000	For SR/TiO_2 producers
	OR	6500	For Non SR/TiO_2 producers
w.e.f. 1.3.2011	Q	5700	Ex-works, loose
	MK	5400	Ex-works, loose
	OR	4250	For SR/TiO_2 producers
	OR	6500	For Non SR/TiO_2 producers
w.e.f. 1.4.2011	Q	5700	Ex-works, loose
	MK	5400	Ex-works, loose
	OR	4250	For SR/TiO_2 producers
	OR	6550	For Non SR/TiO_2 producers
w.e.f. 8.4.2011	Q	8050	Ex-works, loose
	MK	7650	Ex-works, loose
	OR	6000	For SR/TiO_2 producers
	OR	8500	For Non SR/TiO_2 producers
w.e.f. 9.8.2011	Q	12650	For SR/TiO_2 producers with own mining
	Q	17000	For Non SR/TiO_2 customers without own mining
	MK	12450	For SR/TiO_2 producers with own mining
	MK	16100	For Non SR/TiO_2 customers without own mining
	OR	12650	For SR/TiO_2 producers with own mining
	OR	15000	For Non SR/TiO_2 customers without own mining
V.V. Mineral (Average)			
2009-10	Not specified	3009	
2010-11	NA	5940	
2011-12	NA	11174	
BMC			
2009-10	TiO_2 : 48-50%	4050 (US$90)	f.o.b.Thoothukudi
	TiO_2 : >51%	4950 (US$110)	
2010-11	TiO_2 : 48-50%	4500 (US$100)	f.o.b.Thoothukudi
	TiO_2 : >51%	5400 (US$110)	
2011-12	TiO_2 : 49-51%	6500 (US$130)	f.o.b.Thoothukudi
DCW Ltd			
2009-10	NA	4825	–
2010-11	NA	6375	–
2011-12	NA	7693	–

Source: *Department of Atomic Energy, Mumbai.*
Note*: Q: Quilon; MK: Manavalakurichi; OR: Odisha.*

MINING & PROCESSING

Mining and processing of beach sand is carried out by the IREL, a Government of India undertaking, KMML, a Kerala State Government undertaking and two private sector producers; viz, M/s V. V. Mineral, Thoothukudi (Tamil Nadu) and M/s Beach Minerals Co. Pvt. Ltd, Kuttam (Tamil Nadu). IREL is exploiting beach sand deposits located at Chavara in Kerala, Gopalpur in Odisha and Manavalakurichi in Tamil Nadu.

At IREL, Chavara, beach washings are inadequate to meet the full requirement of the plant. The unit, therefore, has adopted wet mining operations involving use of two Dredge and Wet Concentrator (DWC) of 100 tph capacity each to exploit the inland deposits away from the beaches. Chavara ilmenite is the richest in TiO_2 content (75.8% TiO_2) and has great demand in India and abroad for manufacture of pigments.

At Manavalakurichi, deposit is spread over 300 hectares at Thuthoor-Ezudesam villages, Vilavancode tehsil, Kanyakumari district, Tamil Nadu. All the raw sand required to operate the separation plant at its full capacity was collected from nearby beaches by the fishermen of surrounding villages and supplied to the unit at cost. Deposits are also exploited by DWC of 100 tph capacity. Manavalakurichi is next to Chavara in terms of TiO_2 content which is more than 55%.

The sand deposits of OSCOM at Chatrapur in Ganjam district extend along the coast of Bay of Bengal with an average width of 1.4 km and average depth of 7.5 m. Mining operations involve suction dredging to 6 m depth below water level on a much larger scale (500 tph) augmented by a smaller sized (100 tph) supplementary. The ilmenite from OSCOM is inferior in grade in terms of TiO_2 content (50%) in comparison to Chavara and Manavalakurichi. The Synthetic Rutile Plant of OSCOM is presently not working. As a result, the majority of OSCOM ilmenite produced today is finding its way in the international market as feed stock for production of both slag grade and anatase grade pigment.

In dry mining, beach washings laden with 40-70% Heavy Minerals (HM) are collected through front end loaders and bulldozers for further concentration to 90% HM at land-based concentrators. Dry mining is very simple and economic as well. However, it is facing opposition by local people on the ground that removal of sand causes sea erosion. Therefore, collection of beach washings has reduced significantly in recent past.

As an alternate approach, IREL has adopted wet mining involving dredging and wet concentration (DWC) from inland areas away from the beach lines. In this mode, an artificial pond is created, the sand bed is cut and the slurry is pumped to spiral concentrator for removal of quartz. Manavalakurichi was the first plant to install a DWC (100 tph) followed by one (500 tph) at OSCOM and two (each 100 tph) at Chavara. The concentrate (90% HM) of beach washing plant from DWC is further upgraded to 97% HM grade at a Concentrate Upgradation Plant (CUP) before sending it to Mineral Separation Plant (MSP).

KMML collects seasonal accretions of heavy mineral sand from the beach front. The pit so formed gets filled by fresh accretions of heavy mineral sand. The mineral sand is collected using bulldozers and wheel loaders and transported in tippers to Mineral Separation Plant. In the Mineral Separation Unit Project of KMML, a new spiral concentrator was installed in 2008-09.

The mineral separation plants use variety of equipment such as gravity concentrators, high tension electrostatic separators and magnetic separators. Making use of difference in physical properties like electrical conductivity, magnetic susceptibility and difference in specific gravity, etc., individual minerals like ilmenite, rutile, zircon, sillimanite and garnet are separated. The mined beach sands are pre-concentrated and dried after sieving (30-mesh) to separate the heavies from rejects. The heavy minerals are passed through electrostatic separators where conducting minerals – ilmenite and rutile – are separated from other non-conducting minerals. Ilmenite and rutile are further subjected to low-intensity magnetic separators where magnetic fraction - ilmenite is separated from rutile. Similarly, non-conducting fractions are subjected to high-intensity magnetic separators where weakly magnetic fraction (monazite and garnet) is separated from non-magnetic fraction (zircon and sillimanite). The fractions are further processed on wind tables to separate garnet from monazite and sillimanite from zircon.

IREL carried out trial runs of expansion of capacity of ilmenite to 200,000 tonnes at Chavara plant in Kerala and has commissioned it successfully. The company has plan to expand MSP capacity at OSCOM to produce 5 lakh tonnes of ilmenite and associated minerals by the end of 2013. Trimex Group is understood to be gearing up to begin its 200,000 tpy ilmenite and 6,000 tpy rutile project in Srikakulam district, Andhra Pradesh.

Installed capacity and production of ilmenite, rutile and other associated heavy minerals by various separation plants are furnished in Table-6.

Table – 6 : Installed Capacity & Production of Ilmenite, Rutile and Other Heavy Minerals, 2009-10 to 2011-12

(In tonnes)

Company/ Location	Mineral	Specification	Installed capacity (tpy)	Production		
				2009-10	2010-11	2011-12
Indian Rare Earths Ltd						
Manavalakurichi,	Ilmenite	55% TiO_2 (min)	90000	55542	43222	35009
Kanyakumari dist.,	Rutile	94% TiO_2 (min)	4000	1833	1628	1560
Tamil Nadu.	Zircon	65% ZrO_2+HfO_2 (min)	10000	4527	3542	NA
	Sillimanite	58% Al_2O_3	–	67	150	NA
	Monazite	96% pure	6000	–	–	NA
	Garnet	97% pure (min)	8500	13358	14909	NA
Chavara,	Ilmenite	59% TiO_2 (min)	154000+	89532	74320	43051
Kollam dist.,	Rutile	95% TiO_2 (min)	10000	3273	3556	2769
Kerala.	Zircon	65% ZrO_2+HfO_2 (min)	12000	8124	7500	NA
	Rare Earths	–	4500*	16**	NA	NA
	Sillimanite	58% Al_2O_3 (min)	10000	7935	8243	NA
	Leucoxene	–	–	198	110	NA
	Zirflor	-200 mesh	6000	1444	918	NA
		-300 mesh				
	Microzir	1-3 micron	500	–	1627	NA
Orissa Sands Complex,	Ilmenite	50.25% TiO_2 (min)	220000	208781	206138	188000
Ganjam dist., Odisha.	Rutile	94.25% TiO_2 (min)	10000	8034	8044	7874
	Zircon	64.25% ZrO_2+HfO_2 (min)	5000	5906	5979	NA
	Sillimanite	56.5% Al_2O_3 (min)	10000	14117	17889	NA
	Garnet	93.5% garnet (min)	24000	11080	18474	NA
Kerala Minerals & Metals Ltd						
Chavara,	Ilmenite	59.88% TiO_2	51600	44300	38920	43403
Kollam dist.,	Rutile	93.20% TiO_2	3400	3335	2413	2600
Kerala.	Zircon	64.81% ZrO_2	6480	2592	2838	5213
	Sillimanite	NA	3600	–	–	339
V.V. Mineral						
Thoothukudi,	Ilmenite	51.0-52.5% TiO_2	450000	316200	372000	405700
Tamil Nadu.	Rutile	95% TiO_2 (min)	12000	2100	6750	1500
	Zircon@	66% ZrO_2+HfO_2 (min)	18000	6900	13350	6200
	Zircon-sillimanite	NA	24000	7900	8200	4600
	Garnet	NA	150000	120000	120000	_
Beach Minerals Co. Pvt. Ltd						
Kuttam, Tirunelveli dist., Tamil Nadu.	Ilmenite	KU grade 49-51% TiO_2	150000	53000	34000	35150

Source: *Department of Atomic Energy, Mumbai and IREL.*

** In terms of rare earths chloride.*

*** Mainly Rare Earths Fluoride, Cerium Oxide and Cerium Hydrate from conversion of Rare Earths Chloride.*

@ Besides, 7,900 tonnes, 8200 tonnes and 4600 tonnes production of zircon-sillimanite is also reported during 2009-10, 2010-11 and 2011-12 respectively.

+ Expansion of capacity to 200,000 tonnes under trial runs was commissioned successfully.

INDUSTRY

For manufacture of titanium dioxide pigment, ilmenite is first treated chemically to obtain upgraded ilmenite, commonly called as synthetic rutile. There are two major pigment production processes namely chloride process and sulphate process depending on different operating characteristics and feedstock requirements. Plants employing chloride process consume high TiO_2 content feedstocks like synthetic rutile and chloride slag. On the other hand, plants employing the sulphate process use lower grade ilmenite and sulphate slags.

Ilmenite obtained from Mineral Separation Plant (MSP) is chemically treated to remove impurities such as iron to obtain synthetic rutile (90% TiO_2) in Synthetic Rutile Plant (SRP). Indian Synthetic Rutile Plants are based on reduction roasting followed by acid leaching with or without generation of hydrochloric acid. Plants of IREL (OSCOM) and KMML depend on acid regeneration from the leach liquor while those of Cochin Minerals & Rutile Ltd (CMRL) and DCW use fresh acid and recover ferric chloride from the leach liquor for its use in water purification.

At OSCOM plant of IREL, reduction-roasting of ilmenite with coal is followed by leaching with HCl to separate iron as soluble ferrous chloride. The leached ilmenite is calcined to yield synthetic rutile and the acidic leach liquor is treated in an acid regeneration plant to recover HCl for recycling with iron oxide as waste. The unit stopped production in 1997 as it was not viable economically.

The KMML is manufacturing rutile grade titanium dioxide pigment by chloride route at its Sankaramangalam plant near Chavara in Kerala. The project for the production of one lakh tonnes of TiO_2 in a phased manner is under implementation. The company also has plans to enhance pigment capacity to 60,000 tpy for which detailed project report is under preparation. In 2009, the company had developed Nano Titanium Dioxide particles on laboratory scale and in July 2011, India's first commercial plant for synthesis of nano-titanium dioxide was commissioned.

The DCW Ltd procures ilmenite from Manavalakurichi which is then roasted with coke fines to convert Fe_2O_3 into FeO. The reduced ore is leached with concentrated hydrochloric acid to remove oxides of iron and other metals. The leached ore is washed and calcined to get upgraded ilmenite which contains more than 95% TiO_2. The upgraded ilmenite is micronised to 2 microns by using high-pressure steam. This is marketed as Titox. The liquor from ilmenite leaching process contains fine TiO_2 particles and chlorides. The TiO_2 recovered by filtration & washing in filter process is marketed as Utox. The company has plans to increase the capacity of plant to 36,000 tpy and also to install facilities for the manufacture of ferrite grade iron oxide from the effluent of the ilmenite plant.

Cochin Minerals and Rutile Ltd (CMRL), which began production at its 10,000 tpy synthetic rutile plant in Kerala in 1990 as a 100% EOU, has gradually raised the production capacity to around 45,000 tpy since 2008-09 for exports. It also has ferric chloride & ferrous chloride plants having capacities 24,000 tpy & 72,000 tpy, respectively.

The Travancore Titanium Products Ltd (TTPL), a Kerala State Govt. Undertaking, manufactures titanium dioxide pigment by sulphate process at its plant at Kochuveli, Thiruvananthapuram. Ilmenite is reacted with sulphuric acid in digesters and a porous cake is formed. The mass in the solid form is dissolved in dilute sulphuric acid to get titanium in solution as titanium oxysulphate along with other metallic ingredients in ilmenite as their sulphate. The liquor is reduced using scrap iron, when ferric iron gets completely reduced to the ferrous state. The liquor is clarified, concentrated and boiled to precipitate the titanium content as hydrated titania which is then filtered by vacuum filters and calcined. Sulphuric acid required for captive consumption is produced at site using elemental sulphur. Till recently TTPL was the only unit producing anatase grade titanium dioxide pigment in India. TTPL has proposals to expand its capacity to 27,000 tpy, modernise and diversify in stages to produce both anatase and rutile grades titanium dioxide pigment.

DCW Ltd has plans to expand the synthetic rutile capacity to 70,000 tpy after installation of Iron Oxide Plant. Iron oxide pigment will be a value-added product from waste leach liquor.

Tata Steel has proposed a project to produce 1,00,000 tonnes per year titanium dioxide from ilmenite mined from beach sands of Tirunelveli and Thoothukudi districts in southern Tamil Nadu.

The NMDC has signed an MoU with KSIDC and IREL for setting up a synthetic rutile plant in Kerala. The company has applied for prospecting licences in various areas in Odisha, Kerala and Tamil Nadu and sought Swedish technology for mineral separation plant. The Beach Minerals Co. Pvt. Ltd also has plans for production of synthetic rutile from ilmenite. Presently, it only has facility of pilot plant. M/s V. V. Mineral has plans to set up a 5 lakh tpy titanium pigment plant. The project is at approval stage.

Present domestic titanium metal production is negligible. KMML has set up a 500 tpy titanium sponge plant with Defence Metallurgical Research Laboratory (DMRL) technology and first batch of titanium was delivered in September 2011. The plant will be further expanded to 1,000 tpy. IREL is to set up a 10,000 tpy titanium sponge plant at OSCOM for which proposals have been invited on build, operate and own basis. IREL intends to set up titanium slag plant based on ilmenite from OSCOM, Odisha and has signed an MoU with NALCO for this purpose. Depending upon feasibility, further value addition to TiO_2 pigment and titanium sponge will be taken up subsequently. Titanium sponge is imported by Mishra Dhatu Nigam Ltd.Midhani for further processing in the country.

The available data on plantwise capacities & production of synthetic rutile and TiO_2 pigment from 2009-10 to 2011-12 are given in Table-7. However, domestic production of synthetic rutile and TiO_2 pigment is estimated at 100,000 tpy and 60,000 tpy, respectively.

Table –7 : Installed Capacity and Production of Synthetic Rutile/Titanium dioxide Pigment 2009-10 to 2011-12

(In tonnes)

Plant	Location	Specification	Installed capacity (tpy)	Production		
				2009-10	2010-11	2011-12
Total			**243000** (Synthetic rutile)	**70584**	**80936**	**75331**
			84600 (TiO_2 Pigment)	**64108**	**64393**	**54768**
IREL	Orissa Sands Complex, Dist. Ganjam, Odisha.	90.5% TiO_2 (min)	100000 (Synthetic rutile)	-	–	–
KMML	Chavara, Dist. Kollam, Kerala.	92%-93% TiO_2	40000@ (TiO_2-Chloride Process) 50000 (Synthetic rutile)	35931	36879	29117
DCW Ltd	Sahupuram, Dist. Thoothukudi, Tamil Nadu.	95% TiO_2	48000 (Synthetic rutile)	36384	44761	47331
CMRL	Edayar, Dist. Ernakulam, Kerala.	96.5% TiO_2	45000 (Synthetic rutile)	34200	36175	28000
TTPL	Kochuveli, Dist. Thiruvananthapuram, Kerala.	97.5% TiO_2	16000 (TiO_2-Sulphate Process)	15273	15749	12701
VVTi Pigments Pvt. Ltd* (formerly Kilburn Chemicals)	Thoothukudi, Tamil Nadu.	98% TiO_2 (min)	25000 (TiO_2-Sulphate Process)	12460	11441	12122
Kolmak Chemicals Ltd	Kalyani, Dist. Nadia, West Bengal.	NA	3600 (TiO_2-Sulphate Process)	444	324	828

Source: *Department of Atomic Energy, Mumbai and individual companies.*
Note: *KMML captively consumes synthetic rutile while CMRL and DCW export synthetic rutile.*
** Including Kilburn Chemicals. @ Under expansion to 60,000 tpy capacity.*

USES

Ilmenite is used mainly for the manufacture of ferro-titanium and synthetic rutile i.e., titanium dioxide, a white pigment. Because of a unique combination of its superior properties of high refractive index, low specific gravity, high hiding power and opacity and non-toxicity, titanium dioxide finds application in the manufacture of all types of white and pastle shades of paints, white-walled tyres, glazed papers, plastics, printed fabrics, flooring materials like linoleum, pharmaceuticals, soaps, face powders and other cosmetic products, etc. Because of its non-toxic nature, it is used in cosmetics, pharmaceuticals, and even added to foodstuffs as well as in toothpastes to improve their brightness. Titanium dioxide is used in the manufacture of many sunscreen lotions and creams because of its non-toxicity and ultra violet absorption properties. Synthetic rutile is used for coating welding electrodes as flux component and for manufacture of titanium tetrachloride which in turn is used in making titanium sponge. Synthetic rutile is

also used as ingredient of special abrasives. Titanium metal is a versatile material with exceptional characteristics. The lightness, strength and durability of the metal make it an essential metal for the aerospace industry. It is also used in desalination and power generation plants and corrosive chemical industries because of its inertness and resistance to corrosion and high thermal conductivity. Its non-reactive property makes titanium metal one of the few materials that can be used in the human body for orthopaedic use and in pacemakers.

CONSUMPTION

The reported ilmenite consumption is placed at 189,900 tonnes in 2011-12. Bulk ilmenite was consumed for manufacturing synthetic rutile (99.7%), followed by ferro-alloys and welding electrode industry. The reported consumption of rutile in 2011-12 was 24,600 tonnes compared to 22,800 tonnes in 2010-11. Bulk consumption was in paint industry followed by electrode industry. In 2011-12, the reported consumption of ferro-titanium was 1,232 tonnes. About 84% consumption was in iron and steel industry and 15% in alloy steel and foundry industries (Table - 8).

Table – 8 : Consumption of Ilmenite, Rutile and Ferro-Titanium, 2009-10 to 2011-12 (By Industries)

(In tonnes)

Industry	2009-10	2010-11(R)	2011-12(P)
ILMENITE			
All Industries	**208900**	**189900**	**189900**
Electrode	300(5)	300(6)	300(6)
Ferro-alloys	300(4)	300(5)	300(5)
Iron & Steel	–(1)	–(1)	++(1)
Paint	++(2)	++(2)	++(2)
Refractory	++(1)	++(1)	++(1)
Synthetic rutile (Chemical)	208300(5)	189300(5)	189300(5)
RUTILE			
All Industries	**18600**	**22800**	**24600**
Electrode	1700(12)	5500(28)	7100(35)
Paint	16300(10)	16700(13)	16900(13)
Paper	300(3)	300(2)	300(2)
Others (Cosmetic, electrical, rubber)	300(4)	300(4)	300(4)
FERRO-TITANIUM			
All Industries	**1117**	**1215**	**1232**
Alloy steel & foundry	154(5)	191(6)	191(6)
Iron & steel	963(9)	1020(9)	1037(9)
Foundary	-(1)	4(1)	4(1)

Figures rounded off. a collected on statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Includes actual reported consumption and/or estimates made wherever required).*

POLICY

The Government of India had notified in October 1998, a policy on exploitation of beach sand minerals in the country, which inter alia allows participation of private sector with or without foreign companies subject to conditions stipulated. This will encourage further exploitation of mineral deposits through a judicious mix of public & private sector participation including foreign collaboration. The ceiling on FDI on mining of titanium minerals has been raised to 100 percent.

Joint ventures with foreign participation were being pursued by IREL for production of value-added products, keeping in view the Beach Sand Mineral Policy of the Government.

The minerals ilmenite and rutile were grouped as 'prescribed substances' as per notifications issued under the Atomic Energy Act, 1962. However, as per the revised list of Prescribed Substances, Prescribed Equipment and Technology notified by Department of Atomic Energy vide S.O.No.61(E), dated 20.1.2006, the titanium ore minerals like ilmenite, rutile and leucoxene have been delisted as prescribed substances by the Department of Atomic Energy subject to the note as below:

"These minerals shall remain prescribed substances only till such time the policy on Exploration of Beach Sand Minerals notified vide Resolution No.8/1(1)/97-PSU/1422, dated 6.10.1998, is adopted/revised/modified by the Ministry of Mines or till 1.1.2007, whichever occurs earlier and shall cease to be so thereafter".

As per the Foreign Trade Policy, 2009-2014 and the policy on export and import, titanium ores and concentrates under heading 2614 (comprising ilmenite unprocessed and upgraded, i.e., beneficiated ilmenite including ground ilmenite) and rutile sand can be imported/exported freely.

SUBSTITUTES

There are no cost-effective substitutes for titanium dioxide pigments. Synthetic rutile made from ilmenite can be substituted for natural rutile. Nickel steels, stainless steels and some non-ferrous metal alloys can sometimes replace titanium alloys in industrial uses although at the expense of performance or economics. Tungsten carbide competes with titanium carbide for surface cutting machine tools. Titanium slag competes with ilmenite and rutile.

Environmental awareness indicates that titanium dioxide plants are likely to use chloride technology in future as it produces much less quantity of waste products. Synthetic rutile or slag (made from ilmenite)

is likely to be used as feed in increasing amount. There is also a strong pressure to reduce the radioactive content of feed stocks because it affects the marketability of beach sand ilmenite. Titanium alloys may be replaced in aerospace applications by lithium-aluminium alloys or carbon-epoxy composites.

WORLD REVIEW

World resources of anatase, ilmenite and rutile are more than 2 billion tonnes. World reserves of ilmenite are estimated at 650 million tonnes in terms of TiO_2 content. Major reserves are in China (31%), Australia (15%), India (13%), South Africa (10%), Brazil (7%), Madagascar and Norway (6% each) and Mozambique (2%). The world reserves of rutile are 42 million tonnes in terms of TiO_2 content. Major rutile reserves are located in Australia (43%), followed by South Africa (20%), India (18%), Sierra Leone (9%) and Ukraine (6%).

World production of ilmenite and rutile concentrates was 10.9 million and 0.83 million tonnes, respectively, in 2011. Canada contributed 23% of ilmenite production, followed by South Africa (13%) and Australia (12%). Australia produced 57% of world rutile output, followed by South Africa with 16% and Ukraine 12%. World reserves and production of titanium minerals, viz, ilmenite and rutile, are furnished in Tables - 9 to 11, respectively.

Table – 9 : World Reserves of Ilmenite and Rutile (By Principal Countries)

(In '000 tonnes of contained TiO_2)

Country	Reserves	
	Ilmenite	Rutile
World: Total (Ilmenite+Rutile) : 692000		
World: Total (Rounded)	**650500**	**42000**
Australia	100000	18000
Brazil	43000	1200
Canada	31000	–
China	200000	–
India*	85000	7400
Madagascar	40000	–
Mozambique	16000	480
Sierra Leone	–	3800
Norway	37000	–
South Africa	63000	8300
Ukraine	5900	2500
USA	2000	–
Vietnam	1600	–
Other countries	26000	400

***Source**: Mineral Commodity Summaries, 2013.*

** As per the NMI Unit,IBM, the total resources of titanium minerals in India are estimated at about 549.49 million tonnes.*

Table – 10 : World Production of Ilmenite (By Principal Countries)

(In '000 tonnes)

Country	2009	2010	2011
World: Total (wt. of concs)	**10000**	**10400**	**10900**
All form of TiO_2 (e)	**5400**	**5700**	**6100**
Australia Ilmenite	1626	1339	1277
Leucoxene	137	160	225
Canada (e)@	2000	2400	2500
China (e)	900	1000	1000
India*	767	663	700 e
Mozambique	471	678	637
Madagascar	160	273 e	551 e
Norway	671	864	670
South Africa e	1445	1200	1369
USA e	200	200	300
Vietnam e	700	881	870
Ukraine (e)	600	600	600
USA (e)	200	200	200
Other countries	323	142	201

***Source**: World Mineral Production, 2007-2011.*

***Note**: Some ilmenite is converted to synthetic rutile in Australia, India, Japan, Taiwan and USA.*

@ Canada produces some ilmenite which is sold as such and not processed into slag, but tonnages are small.

** India's production of ilmenite in 2009-10, 2010-11 and 2011-12 was 713,605 tonnes and 663,217 and 751,163 tonnes, respectively.*

Table – 11 : World Production of Rutile (By Principal Countries)

(In '000 tonnes)

Country	2009	2010	2011
World: Total (wt. of concs)	**631**	**800**	**832**
Australia	302	438	474
India	19	27	27 e
South Africa	134	135	129
Sierra Leone	64	68	68
Ukraine (e)	100	100	100
Other countries	12	32	34

***Source:** World Mineral Production, 2007-2011.*

World production of TiO_2 contained in titanium mineral concentrates increased by 13% compared with that of 2010. The leading sources of world imports of titanium mineral concentrates were Australia, Canada and South Africa.

Metal

Commercial production of titanium metal involves the chlorination of titanium-containing mineral concentrates to produce titanium tetrachloride ($TiCl_4$), which is reduced with magnesium (Kroll process) or sodium (Hunter process) to form a commercially pure form of titanium metal. As the metal is formed, it has a porous appearance and is referred to as sponge. Titanium ingot and slab are produced by melting titanium sponge or scrap or a combination of both, usually with various other alloying elements.

Pigment

Global TiO_2 pigment production capacity was estimated to be 5.7 million tonnes per year. TiO_2 pigment produced by either process is categorised by crystal form as either anatase or rutile. Rutile pigment is less reactive with the binders in paint when exposed to sunlight than is the anatase pigment and is preferred substance in outdoor paints. Anatase pigment has a bluer tone than rutile, is somewhat softer, and is used mainly in indoor paints and in paper manufacturing. Depending on the manner in which it is produced and subsequently finished, TiO_2 pigment can exhibit a wide range of functional properties, including dispersion, durability opacity, and tinting.

Australia

Iluka Resources Ltd announced its intention to recommence operations at Eneabba in the Perth Basin. Mining was expected to begin in early 2012. Iluka increased its production of rutile in Australia to 282,000 tonnes in 2011 from 250,000 tonnes in 2010. The company's Australian ilmenite production decreased in 2010. Production of synthetic rutile decreased by 18% owing to a 3-month maintenance outage and test work of a new synthetic rutile product from one of its four synthetic rutile kilns in Western Australia.

Canada

Titanium Corp. decommissioned its 18-month demonstration pilot programme at the Canadian Government's Canmet ENERGY facilities. The programme demonstrated technologies designed to recover heavy minerals, bitumen, and solvents; to treat and recover process water; and to reduce the environmental impacts associated with froth tailings streams. After decommissioning the pilot programme, Titanium Corp. was negotiating with oil sands operators to commercialize the process.

Rio Tinto, Fer et Titane (RTFT) planned to expand its operations in Quebec. The expansion would extend the life of its Lac Tio ilmenite plant to 2050 and upgrade the Sorel-Tracy processing plant in Quebec.

China

As per the Chinese Titanium Association, the top 14 titanium sponge producers increased production capacity to 103,500 tpy in 2010 and produced 65,000 tonnes of sponge in 2011, an increase of 13% from that in 2010. Titanium dioxide production in China from 55 producers also reached record levels in 2011 of 1.75 million tonnes, an increase of 19% from production in 2010. China’s imports of titanium concentrates increased by 11% to 2.27 million tonnes in 2011.

Indonesia

Timex Industries Pvt. Ltd announced that it had signed a memorandum of understanding (MoU) with the Republic of Indonesia to construct a titanium complex in Indonesia in three phases. The first phase to develop the production of titanium dioxide pigment was expected to be complete in December 2013. The second and third phases included the production of titanium slag and titanium metal. The entire project was expected to be completed within 8 to 10 years.

Japan

Toho Titanium Co. Ltd began construction in February to expand its titanium sponge capacity at Wakamatsu, Fukuoka. The project was completed in January 2012 and raised the overall sponge capacity of Toho to 28,800 tonnes per year.

OSAKA Titanium technologies Co., Ltd increased sponge production capacity to 40,000 tonnes per year.

Kazakhstan

In Octo, UKTMP and South Korean Pohang Iron and Steel Company (POSCO) began construction in Ust-Kamenogorsk of a melting operation for the production of titanium slab. UKTMP was to supply titanium sponge for further processing by POSCO into titanium sheets. The operation was expected to begin production in 2012.

Tioline Ltd was constructing a heavy-mineral mine and processing operation at the Obukhovsky deposit in the Akmola province. The operation was expected to start production in 2013 and was expected to reach full capacity in 2014 producing 50,000 tonnes of ilmenite, 12,000 tonnes of rutile and 50,000 tonnes of zircon.

Kenya

Base Resources Ltd made investment to develop in the Kwale mine in Kenya and began development in October. Mining was expected to commence in July 2013 and was expected to generate 330,000 tonnes per year of ilmenite, 79,000 tonnes per year of rutile and 30,000 tonnes per year of zircon during the first 7 years of operations.

Mozambique

Kenmare Resources plc Moma operation planned to increase mine capacity by 50% to approximately 1.2 million tonnes per year by 2013.

Pathfinder Minerals plc released the results of a scoping study on its Moebase and Naburi deposits which reported that the two sites contained an estimated 71.7 million tonnes of contained heavy minerals. Pathfinder Minerals also awarded a new mining concession license for its Moebase deposit by the National Directorate of Mines.

Norway

ERAMET Group established a 50-50 joint venture with Mineral Deposits Ltd (MDL) to jointly develop the Grand-Cote mineral sands deposit in Senegal to supply ERAMET's titanium slag plant in Tyssedal, Norway. A feasibility study was underway for a second furnace at the Tyssedal plant that could double the current capacity of 200,000 tonnes per year of heavy-mineral sands.

Paraguay

CIC Resources Ltd's Parana deposit in the Alto Parana and Canindeyu provinces, the company demonstrated a 5 tonne per day pilot project to show the feasibility of producing titanium slag and pig iron co-product. The deposit was estimated to contain 9.1 billion metric tonnes at 7.6% titanium dioxide and 23.6% iron oxide. Production rates were projected to be 500,000 tonnes per year of titanium slag and a similar amount of pig.

Russia

VSMPO-AVISMA Corp. (VSMPO) completed a new prodution line for titanium sponge, raising its capacity to 44,000 tonnes per year. Production at full capacity was to begin in February 2012. In July, VSMPO acquired GPK Titan Ltd and its license for survey and recovery of mineral sand deposits in the northern part of the Centralnoye deposit in the Tambov Region of Russia.

Saudi Arabia

Cristal Global announced the construction of an ilmenite-processing plant in Yanbu having two ilmenite smelting furnaces and require 800,000 tonnes per year of ilmenite to produce 500,000 tonnes per year of 85% titanium slag and 235,000 tonnes per year of pig iron as a co-product. Site preparation was to begin in early 2012 and the plant was expected to become operational in the fourth quarter 2013.

Senegal

ERAMET established a 50-50 Joint Venture with Minerals Deposit Ltd to develop Grand Cote minerals sand deposit which would supply ERAMET's titanium slag plant in Tyssedal, Norway. Production was to begin in late 2013 at an average rate of 575,000 tpy ilmenite, 85,000 tpy zircon, 11,000 tpy leucoxene and 6,000 tpy rutile.

Sierra Leone

Titanium Sierra Rutile Ltd (SRL) announced two projects to increase rutile production by up to 60,000 tonnes per year of rutile and upto 12,000 tonnes per year of ilmenite. A dry mining project was to focus on high-grade pockets of ore in the Lanti deposit to produce an additional 30,000 to 35,000 tonnes per year of rutile and 6,000 to 9,000 tonnes per year of ilmenite by 2013.

South Africa

The Fairbreeze Mine at the KZN operation was to replace the Hillendale Mine and was projected to begin production in 2014.

Sri Lanka

Lanka Mineral Sands Ltd planned to refurbish its Pulmoddai Mine to pre-war levels of 100,000 to 125,000 tonnes per year of rutile and 4,000 tonnes of hi-titanium ilmenite.

Ukraine

Velta LLC plans to begin production at the Birzulvovske mining operation near Korobchino, Kirovograd Oblast in 2012 with capacity of 185,000 tpy ilmenite after the first 3 months of production.

FOREIGN TRADE

Exports

As per the data from DGCI&S, exports of titanium ores & conc. decreased to 0.91 million tonnes in 2011-12 as compared to 1.02 million tonnes in the preceding year. Exports in 2011-12 comprised ilmenite (8,79,522 tonnes), rutile (6,699 tonnes) and other titanium ores (26,758 tonnes) were also exported. Main destinations were China (52%), Netherlands (18%) and Japan (10%).

Exports of titanium and alloys (including waste & scrap) were 399 tonnes in 2011-12 as compared to 211 tonnes in the previous year. Exports were mainly to USA and Germany. Exports of titinum oxide and dioxide (total) increased to 50,194 tonnes in 2011-12 from 50,116 tonnes in 2010-11. Out of total exports in 2011-12, those of titanium dioxide were 5,011 tonnes and other titanium oxides were 45,183 tonnes . Exports were mainly to Japan (60%), Singapore (16%) and China (7%) (Tables-12 to 19).

Imports

As per the data from DGCI&S, imports of titanium ores & conc. rose to 68,501 tonnes in 2011-12 as compared to 66,759 tonnes in the preceding year. Out of total imports of titanium ores & conc. in 2011-12, those of ilmenite were 48,150 tonnes, rutile 14,647 tonnes and other titanium ores were 5,704 tonnes. Main suppliers were Mozambique (63%) and Australia (16%).

Imports of titanium and alloys (including waste & scrap) were 1,504 tonnes in 2011-12 as compared to 822 tonnes in the previous year. Imports were mainly from Japan, China, USA and Italy. Imports of titanium oxide and dioxide (total) were 23,110 tonnes in 2011-12 as compared to 18,694 tonnes in the preceding year. Bulk of these imports were of titanium dioxide (22,635 tonnes) and those of other oxides were 475 tonnes in 2011-12. Imports were mainly from China (31%), USA and Germany (12% each), Rep. of Korea (10%) and Ukraine (6%) (Tables - 20 to 27).

Table – 12 : Exports of Titanium Ores & Conc. : Total (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1028108**	**5632999**	**912979**	**12442284**
China	361540	1810118	472383	5966675
Japan	327583	2066443	90044	2494763
Netherlands	152024	723012	166026	1869760
Korea, Rep. of	56380	208854	56180	676672
Poland	54240	283752	56000	557171
Malaysia	68258	318027	40221	282076
Singapore	2338	69896	2680	202144
Russia	167	7062	26000	178397
Ukraine	706	21580	729	57298
Philippines	420	14998	396	38473
Other countries	4452	109257	2320	118855

Source: *DGCI & S, Kolkata.*

Table – 13 : Exports of Titanium Ores & Conc. (Ilmenite) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1019268**	**5451218**	**879522**	**11499101**
China	357393	1782996	446953	5525027
Japan	327580	2065817	87048	2368140
Netherlands	151860	717446	164196	1735036
Korea, Rep. of	56260	203452	56000	658665
Poland	54240	283752	56000	557171
Malaysia	68230	317044	40000	262912
Singapore	2338	69896	2680	202144
Russia	-	-	26000	178397
Algeria	-	-	324	4707
Nepal	14	2058	140	2583
Other countries	1353	8757	181	4319

Source: *DGCI & S, Kolkata.*

Table – 14 : Exports of Titanium Ores & Conc. (Rutile) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4031**	**144364**	**6699**	**507305**
Netherlands	164	5566	1830	134724
Japan	-	-	996	90201
Ukraine	442	18037	729	57298
China	28	1034	717	43805
Philippines	420	14998	396	38467
Bangladesh	814	31101	522	28347
Iran	1420	45354	587	28295
USA	-	-	274	26246
Malaysia	28	983	221	19164
Korea, Rep. of	120	5401	180	18007
Other countries	595	21890	247	22751

Source: *DGCI & S, Kolkata.*

Table – 15 : Exports of Titanium Ores & Conc. (Others) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4809**	**37417**	**26758**	**435878**
China	4119	26088	24713	397843
Japan	3	626	2000	36423
Bangladesh	9	376	21	827
Brazil	-	-	24	785
Other countries	678	10327	-	-

Source: *DGCI & S, Kolkata.*

Table – 16 : Exports of Titanium & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**211**	**233571**	**399**	**338371**
UAE	2	5576	3	119928
USA	100	36128	169	57496
Saudi Arabia	12	54457	7	33977
Germany	1	1229	118	24024
France	++	2169	10	17246
Singapore	3	6290	38	16907
Norway	2	18081	1	16535
UK	42	17389	21	8459
Philippines	2	13279	2	8101
Israel	++	1436	5	7606
Other countries	47	77537	25	28092

Source: *DGCI & S, Kolkata.*

Table – 17 : Exports of Titanium oxide & Dioxide : Total (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**50116**	**2259041**	**50194**	**3138303**
Japan	16716	565306	30085	1612813
Singapore	13763	419097	8016	318131
China	8480	254182	3600	184572
Italy	1100	133415	1033	171963
Turkey	1773	222554	1198	159353
USA	1958	162416	955	121378
Spain	680	89757	722	109038
Thailand	113	11956	582	77397
Netherlands	60	7792	320	64464
Germany	588	76147	425	61161
Other countries	4885	316419	3258	258033

Source: *DGCI & S, Kolkata.*

Table – 18 : Exports of Titanium dioxide (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**7490**	**879702**	**5011**	**781078**
Italy	974	117802	925	155995
Turkey	1620	213594	1040	150453
Spain	660	89081	720	106764
Netherlands	60	7792	320	64464
Germany	588	76096	421	61060
Japan	829	90804	360	57885
UAE	593	61486	324	54029
USA	697	61521	161	22305
Belgium	-	-	120	20239
Thailand	113	11956	117	15178
Other countries	1356	149570	503	72706

Source: *DGCI & S, Kolkata.*

Table – 19 : Exports of Titanium oxide (Other than Titanium Dioxide) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**42626**	**1379339**	**45183**	**2357225**
Japan	15887	474501	29725	1554927
Singapore	13419	388264	8016	318131
China	8460	251606	3600	184572
USA	1261	100895	794	99073
Thailand	-	-	465	62219
Malaysia	398	28066	717	42104
Nigeria	203	9680	455	28624
Chinese Taipei/ Taiwan	2509	93075	500	24145
Italy	126	15612	108	15968
Turkey	153	8960	158	8900
Other countries	210	8680	645	18562

Source: *DGCI & S, Kolkata.*

Table – 20 : Imports of Titanium Ores & Conc. : Total (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**66759**	**861652**	**68501**	**1731291**
Australia	11550	358684	10904	813202
Mozambique	44578	266494	43406	320241
Sri Lanka	3818	62253	6519	156245
Ukraine	1616	57617	1774	105694
South Africa	1721	60318	1180	85997
Malaysia	1998	13118	1472	47053
China	309	10799	605	41295
Thailand	141	2892	531	28989
Korea Rep. of	-	-	390	27574
Germany	50	419	258	17399
Other countries	978	29058	1462	87602

Source: *DGCI & S, Kolkata.*

Table – 21 : Imports of Titanium Ores & Conc. (Ilmenite) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**48747**	**287449**	**48150**	**389054**
Mozambique	44578	266494	43406	320240
Sri Lanka	2219	8916	3490	46910
Malaysia	1950	12039	908	10774
Australia	-	-	313	9795
Germany	-	-	10	736
Thailand			23	599
Other countries	-	-	-	-

Source: *DGCI & S, Kolkata.*

Table – 22 : Imports of Titanium Ores & Conc. (Rutile) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**13390**	**432741**	**14647**	**1065112**
Australia	9266	289832	8695	670087
Sri Lanka	1425	47608	1348	79992
South Africa	1229	44417	920	69374
Ukraine	595	25054	766	54711
China	154	5179	418	32491
Malaysia	48	1079	428	30688
Korea, Rep. of	-	-	338	22977
Netherlands	-	-	196	15948
Germany	50	419	196	14574
Thailand	-	-	259	12261
Other countries	623	19153	1083	62009

Source: *DGCI & S, Kolkata.*

Table – 23 : Imports of Titanium Ores & Conc. (Others) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4622**	**141462**	**5704**	**277125**
Australia	2284	68852	1896	133320
Ukraine	1021	32563	1008	50983
Sri Lanka	174	5728	1681	29344
South Africa	492	15901	260	16623
Thailand	141	2892	249	16130
China	155	5620	187	8804
Malaysia	-	-	136	5591
Vietnam	200	5284	75	5446
Korea, Rep. of	-	-	52	4597
Chinese Taipei/ Taiwan	-	-	56	2109
Other countries	155	4622	104	4178

Source: *DGCI & S, Kolkata.*

Table – 24 : Imports of Titanium & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**822**	**1135500**	**1504**	**2149522**
USA	78	204967	471	571037
Japan	254	194795	198	310154
Italy	32	29434	184	267345
China	224	226013	191	243696
France	12	37497	93	159201
UK	16	32201	52	121507
Ukraine	35	155480	69	110016
Russia	64	86906	64	89236
Germany	13	22058	57	86497
Korea, Rep. of	6	19189	34	51880
Other countries	88	126960	91	138953

Source: *DGCI & S, Kolkata.*

Table – 25 : Imports of Titanium oxide & Dioxide : Total (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**18694**	**2148503**	**23110**	**3545107**
China	4344	392807	7268	1018172
USA	3416	432564	2777	471130
Germany	2510	337573	2794	440848
Korea, Rep. of	1984	204507	2292	354553
Japan	871	134008	1065	203897
Ukraine	221	21521	1405	189968
Czech Republic	1163	123491	1170	180613
Australia	773	93013	620	107914
Chinese Taipei/Taiwan	566	71122	551	103237
UK	258	34419	387	61634
Other countries	2588	303478	2781	413141

Source: *DGCI & S, Kolkata.*

Table – 26 : Imports of Titanium dioxide (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**18295**	**2093764**	**22635**	**3490219**
China	4343	389550	6940	983819
USA	3356	424521	2766	467628
Germany	2426	324789	2793	440212
Korea, Rep. of	1964	202791	2280	352616
Japan	868	132145	1058	201477
Ukraine	221	21521	1405	189968
Czech Republic	1163	123491	1170	180613
Australia	763	91709	620	107914
Chinese Taipei/ Taiwan	546	68404	551	103237
UK	257	34233	386	61453
Other countries	2388	280610	2666	401282

Source: *DGCI & S, Kolkata.*

Table – 27 : Imports of Titanium oxides (Other than Titanium Dioxides) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**399**	**54739**	**475**	**54888**
China	1	3257	328	34353
Italy	88	3066	71	4120
Hong Kong	++	2	24	3978
USA	60	8043	11	3503
Japan	3	1863	7	2420
Singapore	++	5	14	1967
Korea, Rep. of	20	1715	12	1937
Germany	84	12784	1	636
Turkey	-	-	1	546
France	111	19627	1	514
Other countries	32	4377	5	914

Source : *DGCI & S, Kolkata.*

FUTURE OUTLOOK

The major chunk of consumption of ilmenite is for the manufacture of synthetic rutile. The future demand of ilmenite during the 12th Five Year Plan Period at the GDP growth rate of 8%, 9% and 10% is estimated at 3.19 lakh, 3.27 lakh and 3.35 lakh tonnes, respectively, as per the Report of Working Group on Mineral Exploration and Development (other than coal & lignite) for the 12th Five Year Plan (2012-17), Planning Commission of India.

Demand for rutile for next five years is projected at 44,000 tpy to 45,000 tpy as per the GDP growth rate of 8%, 9% and 10%. The production projected is 30,000 tpy as per the Working Group.

The Working Group has observed that no substantial progress in exploration activities for Beach Minerals was witnessed during the 11th Plan and has stressed on the need to take substantive steps to develop beach sand reserves of the country to its full potential by adopting suitable exploration strategy with modern techniques.

Global demand growth for TiO_2 expected to trend with economic growth and the production of paint, paper and plastics.

Acrospace, defence and industrial uses were expected to strongly influence consumption of titanium metal for the foreseeble future.