

TUNGSTEN



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(Part- II :Metals and Alloys)

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TUNGSTEN

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**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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18 Tungsten

Tungsten, also known as 'wolfram' is a very dense lustrous greyish white to steel-grey metal. It is inherently brittle, therefore, making it more difficult to work with. Tungsten is a metal of strategic importance and is essential for the industrial development of the country. Tungsten does not occur naturally as free metal. The major sources of tungsten are minerals scheelite (Calcium tungstate, CaWO_4) and Wolframite [mixture of ferrous tungstate and manganous tungstate, $(\text{Fe,Mn})\text{WO}_4$] which are predominantly hydrothermal in origin. Tungsten has a melting point of $3,422^\circ\text{C}$, the highest of all metals and is resistant to all acids at ordinary temperatures. It has good corrosion resistance, good thermal & electrical conductivity and low co-efficient of expansion. It is elastic, ductile and has high tensile strength and can be drawn into very thin wires. Tungsten is considered the most important metal for thermo-emission applications not only because of its high electron emissivity but also because of its high thermal and chemical stability. As tungsten has extremely high melting point and is ductile, it is widely used in filaments of light bulbs and vacuum tubes, and for heating elements in electrical furnaces.

When exposed to air, a protective oxide is formed on the surface of the metal, but tungsten can be oxidised more fully at high temperature. When alloyed in small quantities with steel, tungsten greatly increases the hardness of steel.

The domestic requirements of tungsten and its products are met mainly through imports. A significant amount of tungsten is recovered through recycling of tungsten and its alloys including waste & scrap.

RESERVES/RESOURCES

The total resources of tungsten ore in the country, as per NMI data, as on 1.04.2020 based on UNFC system, has been estimated at 89.43 million tonnes with WO_3 content of 1,44,650 tonnes. All these resources are placed under 'Remaining Resources' category.

Resources of tungsten-bearing minerals are mainly distributed in Karnataka (41%), Rajasthan (27%), Andhra Pradesh (17%) and Maharashtra (11%). The remaining 4% resources are in Haryana, Tamil Nadu, Uttarakhnad and West Bengal (Table- 1). Incidences

of WO_3 in tungsten ore have been reported from different areas of the country. At Degana, Rajasthan, in a total of 7 blocks, the minimum and maximum values of WO_3 noticed were 0.09% and 1.62%, respectively. At Balda of Sirohi district, Rajasthan, the average WO_3 content was found to range from 0.24 to 0.48 per cent. In Dewa-Ka-Bera of Sirohi district, the average WO_3 is 0.03% and in Udwarya of Sirohi, it is 0.27%. In West Bengal, Bankura deposit contains an average of 0.1% WO_3 . In Kuhi-Khobana-Agargaon belt of Maharashtra, GSI has estimated resources in Sakoli basin in the district of Bhandara and Nagpur. The analysis showed 0.01 to 0.19% WO_3 in Kuhi block, 0.13 to 0.38% WO_3 in Khobana block and 0.48% WO_3 in Pardi-Dahegaon-Pipalgaon block. Gold ore at Mysore mine of BGML in Karnataka has been reckoned as a potential source of scheelite. The tailing dumps at Kolar Gold Fields contain about 0.01 to 0.05% WO_3 .

EXPLORATION & DEVELOPMENT

The details on exploration and development, if any, are covered in the Review on Exploration & Development under "General Reviews".

PRODUCTION & PRICES

There was no reported production of tungsten ore/concentrate during 2020-21. In the past, production of tungsten was reported from Degana in Rajasthan and Chendapathar in West Bengal. The domestic prices of tungsten ore and concentrate are furnished in the General Review on 'Prices'.

MINING & PROCESSING

Deposits of wolframite that were established at Degana in Rajasthan and at Chendapathar in West Bengal are found associated with quartz veins, with width that varied from a few centimetres to three metres or sometimes even more. In Degana, it is also associated with gravel beds overlain by 2.5 m thick sand.

Gravel mining was carried out in the past in selected areas where wolframite was found to be concentrated. The overburden sand was at first loosened and loaded manually and transported by tractor unit to dump sites. The payable gravel was then worked.

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Table -1 : Reserves/Resources of Tungsten as on 1.4.2020 (P)
(By Grades/States)

Grade/State	Reserve Total (A)	Remaining Resources							Total Resources (A+B)
		Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total									
Ore	0	2230000	173063	23276152	23259954	23912049	16581246	89432464	89432464
Contained WO ₃	0	3568	450	19298.8	16994.84	99772.15	4566.28	144650.1	144650.1
By States									
Andhra Pradesh									
Ore	0	0	0	3640000	4700800	5952500	509000	14802300	14802300
Contained WO ₃	0	0	0	5096	6574.64	8273.65	318.28	20262.57	20262.57
Haryana									
Ore	0	2230000	0	0	0	0	0	2230000	2230000
Contained WO ₃	0	3568	0	0	0	0	0	3568	3568
Karnataka									
Ore	0	0	0	15361152	11805499	172921	9338246	36677818	36677818
Contained WO ₃	0	0	0	2915	1775	142	1403	6235	6235
Maharashtra									
Ore	0	0	0	4275000	5461250	386000	0	10122250	10122250
Contained WO ₃	0	0	0	11287.8	7117.92	185	0	18590.72	18590.72
Rajasthan									
Ore	0	0	0	0	963666	17000628	5964000	23928294	23928294
Contained WO ₃	0	0	0	0	1421.44	90171.5	2115	93707.94	93707.94
Tamil Nadu									
Ore	0	0	0	0	0	0	250000	250000	250000
Contained WO ₃	0	0	0	0	0	0	50	50	50
Uttarakhand									
Ore	0	0	0	0	138000	0	520000	658000	658000
Contained WO ₃	0	0	0	0	25	0	680	705	705
West Bengal									
Ore	0	0	173063	0	190739	400000	0	763802	763802
Contained WO ₃	0	0	450	0	80.84	1000	0	1530.84	1530.84

In case of vein deposits, the orebody was cut with chisel and hammer at convenient places to form undercuts. At Degana, tungsten orebody occurs as vein, stockwork and alluvial deposits. Inclined veins were developed by putting adits in the stockwork.

Degana in Rajasthan and Chendapathar in West Bengal were the only mines of tungsten in India that had produced meagre quantities of concentrate. These mines, owing to economic non-viability, had to be closed down.

As per Annual Report of NMDC for 2020-21, the Company has submitted a proposal for reservation of Khobna Tungsten Block, Nagpur District, Maharashtra under Section 17(A) (2A) of MM (D&R) Amendment Act, 2015, for tungsten prospecting and exploitation.

The matter is being pursued with Govt. of Maharashtra. NMDC has a majority stake of 90.05% in Legacy Iron Ore Limited, an ASX listed entity based in Perth, Australia which has iron ore (magnetite), gold, nickel, base metal and tungsten interests (total 21 tenements) in Western Australia.

USES

Tungsten is mainly used in the form of ferro-tungsten in making of special and alloy steels and military applications. Ferrotungsten typically contains between 25% and 75% tungsten. The other principal use of tungsten is in the manufacture of tungsten carbide, one of the hardest synthetic materials used in various industries like construction, metalworking, mining and oil drilling. It is used widely in the manufacture of cutting tools & devices and in wear-resistant materials, particularly those that need to be operated at high temperatures. In making this, cobalt or nickel metal powder is used as a binder to hold together the tungsten carbide grains.

Tungsten compounds are used in dyes and pigments; manufacture of paints & printing ink; and also in Ceramic Industry for producing yellow tint. Other alloys bearing tungsten have wide range of applications, i.e., ornaments, heat sinks, radiation shielding, weights & counter-weights, superalloys for turbine parts, tool steels wear-resistant alloy parts & coatings, etc.

Tungsten alloys and tungsten composites are used as a substitute for lead in bullet and shot. Tungsten is used as filament in incandescent light

bulbs and cathodes for electronic tubes, cell phones, television set, HID lamps and other electrical consumer products. The metal is used in superalloys with copper or silver and in Chemical Industry. Tungsten carbide is often used in armor-piercing ammunition.

SUBSTITUTES

Tungsten remains essentially unsubstitutable in its use for production of filaments, electrodes and contacts in lamp & lighting applications. However, an electrodeless, non-tungsten lamp is available as alternative for commercial and industrial uses. Titanium, tantalum and niobium carbides can be used in certain wear-resistant applications. Molybdenum tool steels and tungsten tool steels are interchangeable. In some cutting tool applications, bulk ceramic is an alternative. In some applications, substitution would most often result in increased cost or reduction in product performance.

TECHNICAL POSSIBILITIES

Further development of new metal shaping methods, i.e., laser is becoming a viable proposition. Development of new cutting tool materials coating on cemented carbide parts, that increase their useful life could reduce the usage of tungsten. There is increase in the use of tungsten scrap. The recycling of tungsten-bearing scrap and the recovery of tungsten from scrap materials are well-established practices for a number of reasons. The value of tungsten and other metals present in the scrap, such as, cobalt, columbium, copper, nickel, rhenium, silver, titanium and tantalum, is worthy enough reason to recycle them from scrap. Recycling of tungsten in high speed steel is high and a typical melt contains about 60-70% of the metal scrap, including from that of internally generated scrap. On the other hand, recycling in such applications as lamp filaments, welding electrodes and chemicals uses is also considered viable. Recycling is more environment-friendly and more practicable in economic terms than disposing as waste. Scrap recycling is an important factor in the world's tungsten supply.

POLICY

As per the Foreign Trade Policy, 2015-20, the imports and exports of tungsten ores and concentrates (HS Code 26110000) are allowed free.

CONSUMPTION

The entire domestic requirement of tungsten ore/concentrates is met by imports. Sandvik Asia Pvt. Ltd, Pune, Maharashtra; Widia (India) Ltd, Bengaluru, Karnataka; Rapicut Carbides Ltd, Ankleshwar, Gujarat; Mishra Dhatu Nigam Ltd, Hyderabad, Telangana; and Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra were the important consumers of ferrotungsten for production of alloy steel. However, the current information regarding consumption of ferrotungsten by these companies are not available. Mining Machinery Industry is the main consumer of the imported ore/concentrates.

WORLD REVIEW

World tungsten resources are geographically widespread. China ranks first in the world in terms of tungsten resources and reserves and has some of the largest deposits. The world reserves of tungsten in terms of metal content are about 3.8 million tonnes, distributed broadly amongst China (47%), Russia (11%), Vietnam (3%) and Spain (1%) (Table-2).

The world mine production of tungsten in terms of metal content in 2021 increased marginally by 9% to 1,00,700 tonnes from 9,25,00 tonnes in 2020. China was the leading producer (75%) followed by Vietnam (15%), Russia (3%) and Austria, Bolivia, & Rwanda (1% each) (Table-3).

**Table - 2: World Reserves of Tungsten
(By Principal Countries)**

(In '000 tonnes of Tungsten content)	
Country	Reserves
World: Total (rounded)	3800
Austria	10
Bolivia	NA
China	1800
Portugal	3.1
Russia	400
Rwanda	NA
Spain	56
USA	NA
Vietnam	100
Other countries	1400

Source: USGS, Mineral Commodity Summaries, 2022

**Table – 3 : World Mine Production of Tungsten
(By Principal Countries)**

(In tonnes of metal content)			
Country	2019	2020	2021
World:Total (rounded)	90400	92500	100700
Austria	892	896	919
Bolivia	813	1030	1194
China	75452	76000	76000
Congo, Dem. R.	700	128	127
Korea,Rep.of	1130 ^e	1100 ^e	500
Russia	2825	2692	2700
Rwanda ^a	1303	956	1281
Spain	414	184	643
Vietnam	4816	8066	15858
Other countries	2055	1463	1947

Source: BGS, World Mineral Production, 2016-2020.

a:Includes exports and year ended 30 June of that stated

FOREIGN TRADE

Exports

Exports of tungsten and alloys including scrap increased by 31% to 1209 tonnes in 2021-22 from 292 tonnes in the previous year. Exports were mainly to Germany (57%), USA (22%), Netherland and Japan (5% each), Vietnam (3%), Singapur (1%). In the year 2020-21 and 2019-20, exports of tungsten ore & concentrates were reported as Nil (Tables-4 to 11)

Fig.

Imports

Imports of tungsten and alloys including scrap increased by 12% to 364 tonnes in 2021-22 from 326 tonnes in the previous year. Imports were mainly from China (53%), Austria (15%), Korea, Rep. of (13%), Israel (7%), USA (4%) Argentina (3%). Imports of tungsten ores and concentrates also decreased by 73% to 121 tonnes in 2020-21 from 447 tonnes in the previous year. Imports were mainly from Netherlands (50%) followed by Japan (35%) and Belgium (15%) (Tables-12 to 21) **Fig.**

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**Table-4: Exports of Tungsten and Alloys Incl. Scrap
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	292331	835275	1209171	2600160
Germany	148034	227357	692745	1277587
U S A	315543	42911	263618	460630
Japan	18744	108756	61672	249530
Sweden	20575	48912	20982	66287
Netherland	40	3916	62795	63901
Singapore	4294	51744	13134	52820
Vietnam Soc Rep	-	-	40000	50028
Italy	2886	24552	3535	43700
Poland	1852	33891	2438	43658
Bangladesh Pr	4904	40165	1360	35023
Other countries	75459	253071	46892	256996

*Figures rounded off***Table-5: Exports of Tungsten Wire
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	16999	296924	32589	461540
Japan	5338	93616	12535	170941
Germany	2445	55020	9001	84318
Poland	1852	33891	2438	43658
U S A	610	14110	765	38227
Italy	1858	22503	2138	28660
Sweden	564	8930	981	19607
France	745	12023	926	15456
Switzerland	546	9611	727	14616
Korea Rp	919	14684	796	12809
China P Rp	346	10127	716	7638
Other countries	1776	22409	1566	25610

Figures rounded off

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**Table-6: Exports of Tungsten Waste & Scrap
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	87	20798	25	14810
UK	-	-	++	4306
Korea Rp	10	3197	5	3452
Germany	-	-	5	3095
U S A	45	6321	11	2181
Netherland	6	1983	4	1646
Saudi Arab	-	-	++	130
Estonia	26	8779	-	-
U Arab Emts	++	498	-	-
Sudan	++	20	-	-

*Figures rounded off***Table-7: Exports of Tungsten Unwrought
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	48391	58097	138260	252246
Germany	32910	38030	130450	233890
Taiwan	-	-	6445	12169
U S A	-	-	1175	5153
Nigeria	997	711	46	346
Tanzania Rep	11	25	52	296
Bangladesh Pr	105	26	41	132
Oman	10	27	6	67
Mexico	-	-	1	52
Singapore	3	35	1	42
Algeria	-	-	10	28
Other countries	14355	19243	33	71

Figures rounded off

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**Table-8: Exports of Tungsten Filament
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	5027	51388	4428	54764
Bangladesh	4341	39933	1100	34655
Italy	-	-	1278	13220
Sri Lanka	178	3338	152	3689
China	28	923	20	1325
Korea Rp	3	41	15	572
Austria	-	-	27	513
Kenya	-	-	1801	422
U Arab Emts	38	777	5	329
Nigeria	10	108	++	16
Zambia	6	15	12	13
Other countries	423	6253	18	10

Figures rounded off

**Table-9: Exports of Tungsten & Alloys Unwrought
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	77307	254587	421077	861375
Germany	5479	9801	179772	316167
U S A	14933	28801	169168	266605
Sweden	20011	39982	20001	46680
Singapore	4291	51709	2047	35953
Netherland	29	3580	16026	33410
Mexico	3626	26612	4438	29699
Austria	1043	2380	11230	27759
Thailand	5459	25002	3629	25379
Taiwan	1575	16413	325	12901
Japan	-	-	8316	12041
Other countries	20861	50307	6125	54781

Figures rounded off

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**Table-10: Exports of Tungsten Powder
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	8083	17188	42344	46348
USA	7663	15684	41268	43833
Malaysia	300	1033	600	2171
Serbia	-	-	50	166
Cameroon	-	-	400	88
Puerto Rico	-	-	20	79
Egypt A Rp	100	426	2	9
Somalia	-	-	3	2
Thailand	-	-	1	++
Sri Lanka Dsr	20	45	-	-

*Figures rounded off***Table-11: Exports of Tungsten & Alloys: Worked Nes
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	69224	237399	378733	815027
Germany	5479	9801	179772	316167
USA	7270	13117	127900	222772
Sweden	20011	39982	20001	46680
Singapore	4291	51709	2047	35953
Netherland	29	3580	16026	33410
Mexico	3626	26612	4438	29699
Austria	1043	2380	11230	27759
Thailand	5459	25002	3628	25379
Taiwan	1575	16413	325	12901
Japan	-	-	8316	12041
Other Countries	20441	48803	5050	52266

Figures rounded off

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**Table –12: Imports of Tungsten & Alloys Incl. Scrap
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	326673	1451447	364880	1805805
China	141891	522068	193706	751235
Austria	51301	448758	53442	509209
Korea, Rep. of	44631	142538	48166	176738
Singapore	9643	57729	4547	67070
Israel	8062	20522	20700	61552
USA	42767	100869	13626	59072
Germany	8316	40968	7108	56867
Argentina	7000	30091	10000	42772
Switzerland	1285	15366	2187	16012
Vietnam Soc Rep	-	-	6000	15895
Other countries	11777	72538	5398	49383

*Figures rounded off***Table - 13: Imports of Tungsten Ores & Conc.
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	121	9104	151	14800
Netherlands	61	3542	132	31703
Japan	42	3334	19	3334
Belgium	18	1789	--	1789
Singapore	++	431	--	439

*Figures rounded off***Table-14: Imports of Ferro-Tungsten
(By Countries)**

	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	13	23282	2	4892
China	9	15511	2	4892
Belgium	4	7448	-	-
USA	++	171	-	-
Turkey	-	152	-	-

Figures rounded off

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**Table-15: Imports of Tungsten Wire
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	106049	565540	105309	671803
Austria	31614	253195	35613	334826
China P Rp	68502	296869	67771	311494
Singapore	1	24	1174	5852
Hong Kong	23	856	200	2612
Japan	71	182	27	2345
U S A	17	261	72	1594
Germany	-	-	25	698
Switzerland	14	127	10	470
UK	648	1419	210	468
Hungary	107	2323	2	84
Other countries	52	501	3	7

*Figures rounded off***Table-16: Imports of Tungsten Waste & Scrap
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	--	--	-	-
UK	--	--	-	-
Belgium	--	--	-	-
Germany	--	--	-	-

*Figures rounded off***Table-17: Imports of Tungsten Unwrought
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	41373	141036	60232	188890
China P Rp	23787	62078	47610	145888
Vietnam Soc Rep	-	-	6000	15895
U S A	10693	30037	5080	13565
Germany	1611	6115	533	5160
Italy	798	4195	602	3449
Austria	3123	25184	186	1564
Canada	-	-	58	1245
Singapore	-	-	102	1083
Japan	-	-	61	1041
U K	208	7687	-	-
Other Countries	1153	5740	-	-

Figures rounded off

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**Table-18: Imports of Tungsten Filament
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	1155	36975	976	33532
Korea, Rep. of	540	21610	547	15854
Taiwan	143	7057	132	10370
Germany	79	1928	49	2517
China P Rp	192	2436	116	1896
Singapore	1	100	53	1761
USA	15	441	25	851
Switzerland	1	27	10	159
Austria	9	94	5	61
Japan	4	300	++	19
Italy	-	-	++	15
Other countries	171	2982	39	29

*Figures rounded off***Table-19: Imports of Tungsten Powder
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	99353	273186	101914	367127
Korea, Rep. of	43550	117607	47305	158287
Israel	8000	19977	20700	61552
China	12411	33759	16119	52969
Argentina	7000	30091	10000	42772
Germany	3521	20327	4665	29397
USA	24431	48979	2406	19097
France	251	1796	490	2034
UK	-	-	200	783
Singapore	10	67	29	236
Thailand	150	499	-	-
Other countries	29	84	-	-

Figures rounded off

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**Table-20: Imports of Tungsten & Alloys: Worked Nes
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	78743	434710	96449	544453
China P Rp	36999	126926	62090	238988
Austria	16555	170285	17638	172758
Singapore	4525	45456	4159	52553
USA	7557	21230	6088	23214
Germany	3088	12337	1789	18199
Switzerland	1284	15339	2152	15155
Japan	579	12147	377	8230
France	178	2031	1104	5998
Canada	-	-	336	2631
Korea Rp	536	3292	311	2590
Other countries	7442	25667	405	4137

*Figures rounded off***Table-21: Imports of Tungsten & Alloys Unwrought
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	178096	707896	198363	911580
China P Rp	49410	160685	78209	291957
Austria	16555	170285	17638	172758
Korea, Rep. of	44086	120899	47616	160877
Israel	8058	20512	20700	61552
Singapore	4535	45523	4188	52789
Germany	6609	32664	6454	47596
Argentina	7000	30091	10000	42772
USA	31988	70209	8494	42311
Switzerland	1284	15339	2152	15
Japan	579	12147	377	8230
Other countries	7992	29542	2535	15583

Figures rounded off

FUTURE OUTLOOK

Strong growth in tungsten market is driven by the surging demand for downstream tungsten products in varied end-user sectors including automotive, industrial engineering, energy and aviation. Apart from that, the uncovering of a wide-range of applications in allied industries like medical, defense and electric & electronic, has had an impelling effect on growth of the tungsten market.

Based on application, global tungsten market has been segmented into tungsten carbide, metal alloys, mill products and other applications, such as, salts, tungstates, sulfides, oxides, etc. Carbide is the largest application segment and usage of these products as drilling, boring and cutting tools in various industries will drive its market. Mill products of tungsten and their applications are another important segment. Mill products are pure tungsten metal products, such as, electrodes, lighting filaments, electrical & electronic contacts, sheets, wires, rods, etc. Developments in the Electronics Industry will be the major factor driving the mill tungsten market growth.

In India, the entire demand of tungsten can only be met by imports and recycling, as there is no

indigenous production of tungsten ore & concentrates. High content of WO_3 in the tailing dumps of Kolar can be worked on priority basis to meet the demand.

World tungsten supply was dominated by production in China and exports from China. China's Government regulated its Tungsten Industry by limiting the number of mining and export licences, imposing quotas on concentrate production, and placing constraints on mining and processing. Scrap continued to be an important source of raw material for the Tungsten Industry worldwide. China was the world's leading tungsten consumer.

As per Tungsten - Outlook to 2030, 15th Edition by Roskill, China has for several decades been the world's largest mine and refined producer of tungsten, accounting for just over 80% of mine output in 2020. It is similarly dominant in the production of the tungsten intermediates ammonium paratungstate and tungsten oxide, and of tungsten metal powder and tungsten carbide. A large proportion of this output feeds the country's substantial Cemented Carbide Tool Sector, but there is also sizeable export of tungsten refined and finished products to the rest of the world – making Chinese mine and refined production of tungsten integral to conditions in the global market.