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(Part- II :Metals and Alloys)

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PLATINIUM AND PALLADIUM

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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13 Platinum and Palladium

Platinum Group of Metals (PGM) is a family comprised of 6 metals—platinum, palladium, rhodium, iridium, osmium and ruthenium. They have similar physical and chemical properties and tend to occur together in the same mineral deposits. These six elements are classified into two groups with reference to the specific gravity of gold (19.2). The elements, Ru, Rh, Pd (sp. gr. 12–12.4) are lighter, while the other three specific gravity elements, Os, Ir and Pt are heavier than gold within the range of 21.0–21.5. Platinum is an extremely rare metal occurring at a concentration of only 0.005 ppm in earth's crust. Major applications of platinum and palladium are in automotive sector for emission control and in chemical and petroleum refining.

RESERVES/RESOURCES

Reserves/Resources of PGM in the country as on 1.4.2015 as per NMI Database, based on UNFC System, are placed at 15.71 tonnes of metal content. Reserves/Resources are grouped under Remaining Resources category. By State, Odisha alone accounts for 90% of country's reserves/resources of PGE followed by Karnataka (10%) and Uttar Pradesh with negligible amount (Table-1).

Boula-Nausahi, a 3 km-long belt, 170 km NE of Bhubaneswar, Odisha, is the only proven Platinum Group of Metals (PGM) deposit in the country. Preliminary assessment of PGMs in Sukinda ultramafic field indicated isolated anomalous values in chromite. Platinum values of 2 to 400 ppb and palladium values of 1 to 500 ppb were established on analysis. The limonite cappings over ultramafic rocks showed combined platinum and palladium values between 40 and 290 ppb. In Boula-Nuasahi ultramafic complex, the easternmost chromite band known as Shankar-Ganga load, investigations revealed potential PGM mineralisation. In Sittampudi Complex, Salem district, Tamil Nadu, analysis of chromite bands showed 0.03 to 0.75 ppm Pt and 0.1 to 1.0 ppm Pd, whereas amphibolite samples showed 0.03 to 0.05 ppm Pt and 0.03 to 0.5 ppm Pd. A platinum-rich chromite-ferro-chromite breccia zone stretching to about hundred metres in gabbroic matrix was identified in the southern extension of the already known Boula-Nuasahi area in Kendujhar district, Odisha. In Usgaon area, Southern Goa, PGM samples analysed up to 0.03 ppm Pt and 0.03 to 0.15 ppm Pd.

In recent past, occurrences of PGE mineralisation were reported in mafic-ultramafic complex of Shivamogga schist belt in Davanagere district of Karnataka. Three zones having 10 to 830 ppb of platinum and 50 to 1500 ppb of palladium were established.

The major part of 15.7 tonnes of metal content UNFC reserves/resources of PGM estimated so far about 14.2 tonnes of metal content of PGM are located in Niligiri, Boula-Nuasahi and Sukinda areas in Odisha and remaining 1.5 tonnes of metal content of PGM in Hanumalpura area in Shivamogga schist belt of Karnataka. About 49% resources are under Indicated category and the remaining under Inferred and Reconnaissance categories. The reserves/resources of PGM in Uttar Pradesh have been reported here for the first time in consonance with NMI as on 1.4.2015 (Table-1).

Table – 1: Reserves/Resources of PGM as on 1.4.2015

(In tonnes of metal content)

State	Reserves Total (A)	Remaining resources				Total Resources
		Indicated STD 332	Inferred STD 333	Reconnaissance STD 334	Total (B)	Total (A+B)
India	-	**7.71**	**6.5**	**1.5**	**15.71**	**15.71**
Karnataka	-	-	-	1.5	1.5	1.5
Odisha	-	7.7	6.5	-	14.2	14.2
Uttar Pradesh	-	0.01	-	-	0.01	0.01

EXPLORATION & DEVELOPMENT

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

USES

China and India are moving forward with large-scale plans to reduce the amount of carbon emission in their respective countries. Currently, more than half of platinum and palladium mineral goes into making catalytic converters in automobiles. Automobiles that run on diesel predominantly use platinum for catalytic conversion. Platinum-cured silicones are used to coat and protect automotive air bags from their explosive system. The air bags contain an initiator sensor, which uses a fine platinum wire coated with explosive material to facilitate release of the air bag. The chemical inertness and refractory properties of these metals are conducive for their applications in electrical, electronics, dental, medical fields and glass industry. These metals are also used as catalyst in various chemical processes, viz, in organic synthesis in hydrogenation, de-hydrogenation and isomerisation, production of nitric acid, the raw material for the manufacture of fertilizers, explosives & polymers and fabrication of laboratory equipment.

In addition, platinum, palladium and a variety of complex gold-silver-copper alloys are used as dental restorative materials. The non-corrosive and non-allergic properties of platinum find varied applications in the medical field. Platinum's excellent compatibility with living tissue unaffected by the oxidising reaction of blood, enables its utility in pacemakers.

The primary usage of PGM is in chemotherapy for treatment of cancer. It has the ability to prevent division of certain living cells, a remarkable characteristic which finds profound application in treatment of cancer. Besides, platinum-iridium alloys are extensively used in prosthetics and biomedical devices.

Platinum's excellent conductivity lends itself for use in the electrodes of phosphoric acid fuel cells for generating electricity. Another significant use of platinum and its alloys, in cast or wrought form is in jewellery. Platinum-iridium alloys find major application in making crucibles for growing crystals. Glass made with platinum and rhodium is used in housing construction, flat screen televisions, computer monitors, display panels, automobile displays, factory monitoring equipment, etc. Recently, a new metallic glass featuring micro-alloys of palladium with silicon, germanium, silver, etc. was reportedly developed at University of California. The glass is characterised by strength and toughness. Platinum is used to enhance storage capacity of devices, such as, computer hard discs, cellphones, digital cameras and personal music players. Recently, palladium-silver resistors have been used in secondary lightning surge protection devices. In Electronic Industry, palladium's use is for Multi-Layer Ceramic Capacitors (MLCC). The effect of miniaturisation of MLCC has not reduced the quantum of palladium used as more number of MLCC are required for the same electronic device. Platinum-based fuel cells are proving to be more cost-effective, cleaner and more reliable than alternatives, such as, diesel generators.

Rhodium usage is also on the rise in the Automotive Industry apart from fibre glass. Platinum is the catalyst used by fuel cells to convert hydrogen and oxygen to electricity.

Palladium is also likely to play a role in fuel cells. Platinum acts as an effective and durable catalyst in hydrogen-powered Fuel Cell Electric Vehicles (FCEVs).

SUBSTITUTES

Platinum and palladium are two of the most expensive metals on the planet. Platinum is currently about 30% more expensive than gold while palladium is about half the cost of gold. It is usually easier to substitute metals of the platinum group for one another, especially in alloys, than to use alternative materials, which is evident from the total dominance of ruthenium-based resistors over the palladium-silver resistors for high-powered applications. Substitutes in electrical use include tungsten, nickel, silver, gold and silicon carbide. Alternative catalysts include nickel, molybdenum, tungsten, chromium, cobalt, vanadium, silver and rare earths. Rhenium, however, has been used most satisfactorily as substitute for platinum as a catalyst in petroleum refining. Stainless steel and ceramics can be

substituted where resistance to corrosion is the primary concern. Some motor vehicle manufacturers have substituted platinum by palladium in catalytic converters, especially for petrol engines. Particulate matter and residual sulphur contaminate palladium and hence, it was excluded from catalysts used in diesel vehicles. A new technology now allows up to 25% substitution of platinum in diesel catalytic converters with palladium.

Similarly, manufacturers of electronic parts are also reducing the average palladium content of the conductive pastes used to form the electrodes of multi-layer ceramic capacitors, substituting base metals or silver-palladium pastes which contain significantly less palladium.

Rhenium, tungsten and molybdenum as substitute for platinum in aeromatics hydrogenation catalysts have been investigated. Recently, a new type of iron and carbon-based catalysts has been discovered which is stable and active in both acidic and alkaline media and may even eliminate the need of platinum in catalysts and thus revolutionise the Proton Exchange Membrane Fuel Cell (PEFC) Industry.

TECHNICAL POSSIBILITIES

The spent converters contain platinum and palladium in 3:1 ratio, but heavy shift towards use of palladium to meet stringent emission controls will change this proportion of recovery.

The emergence of Polymer Electrolytic Membrane (PEM) fuel cells developed for passenger cars and trucks will boost prospects of platinum in near future by replacing the high energy battery-operated options for emission controls. The costs of higher range of driving and quick refuelling of fuel cells are, however, 10 times more than the cost of petrol engine.

The development of Solid Oxide Fuel Cell (SOFC) in Japan will eliminate the use of platinum converter as it is compact and gives consistent performance as conversion of conventional fuels into hydrogen is avoided.

Recycling is a significant factor in the supply of many of the metals used in our society. It plays an important role in lowering the environmental foot-print of global PGM production. Over 95% of the PGM content of spent automotive catalysts can be repeatedly recovered. Cellphones are one of the major sources of secondary metals. Falconbridge Ltd estimated that in 1 tonne of obsolete cellphones (excluding batteries) the average palladium and platinum was about 130 g and 8 g, respectively.

RESEARCH & DEVELOPMENT

The Mineral Processing Department of the Institute of Minerals & Material Technology (IMMT), Bhubaneswar (CSIR) had envisaged projects to pursue research focused on recovery of PGE values from the low tenor hosts like Boula-Nuasahi igneous complex by adopting suitable beneficiation tests and development of process flow sheet for recovery of PGE from Indian ores. The methods adopted elsewhere in the world perhaps may not suit in India because the PGE occurs in oxide of chromium and sulphide facies in very fine inclusions & exsolution form.

Bench-scale beneficiation of low-grade PGM samples from T2 sector, Tasampalayam block in Sitampundi Anorthosite complex in Tamil Nadu for GSI was carried out at the Modern Mineral Processing Laboratory and Pilot Plant, IBM, with the objective of enriching platinum group metal present in the sample and to envolve a suitable process flow sheet for recovery of PGM concentrate and chromite. The study indicated that the samples are amenable to beneficiation to produce platinum group of minerals.

WORLD REVIEW

The world reserves of PGM are estimated at 69,000 tonnes concentrated mostly in South Africa (91%) followed by Russia (6%), Zimbabwe (2%) and USA (1%) (Table - 2).

Table – 2 : World Reserves of Platinum Group Metals (By Principal Countries)

(In kilograms of PGM content)

Country	Reserves
World: Total (*rounded off*)	**69000000**
Canada	310000
Russia	3900000
South Africa	63000000
USA	900000
Zimbabwe	1200000
Other countries	NA

Source: *USGS, Mineral Commodity Summaries, 2020*

In 2018, world mine production of PGMs increased slightly by 2% to 460 tonnes of metal content from 451 tonnes of metal content in the preceding year (Table-3).

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

(In kilograms of metal content)

Country	2016	2017	2018
World:Total	**453000**	**451000**	**460000**
Canada[e]			
Platinum[e]	11300	9800	1000
Palladium[e]	19700	17100	17400
Other platinum metals[e]	1300	1100	1100
China			
Platinum	3000	2500	2500
Palladium	1300	1400	1300
Russia			
Platinum [a]	20500	22100	20200
Palladium[a]	78300	83800	83100
Other platinum metals[a]	2600	2400	2100
South Africa			
Platinum	133241	131247	137053
Palladium	76273	80134	80629
Other platinum metals	54139	48895	52964
USA			
Platinum	3890	3980	4100[e]
Palladium	13070	13600	14000[e]
Other platinum metals	103	100	100[e]
Zimbabwe			
Platinum	15110	14257	14703
Palladium	12222	11822	12094
Other platinum metals	3093	3005	3076
Other countries (Platinum Group Metals)	3.97	3.88	3.70

Source: *BGS, World Mineral Production, 2014-2018.*
(a) Sales from mine production and stocks.
(b) Platinum group metals, all forms.
(c) Sales from mine production and stocks.
(d) Years ending 7th July of that stated.

South Africa, which accounted for 59% of the total PGM mine production in 2018 was followed by Russia (23%), Zimbabwe & Canada (6% each), USA (4%) and other countries 2%. In 2018, world mine platinum production increased by 3% to 190.15 tonnes of metal content as against 185.35 tonnes of metal content in the preceding year. South Africa which accounted for 72% of world mine platinum production total at 137 tonnes of metal content, reported about 4% increas from that of 2017. Global mine production of palladium in 2018 at 210.28 tonnes showed a slight increase from 209.74 tonnes in metal content in 2017. Russia accounted for 40% and was followed by South Africa (38%), Canada (8%), USA (7%) and Zimbabwe (6%). A negligible 1% was contributed by other countries. World mine production of other PGMs (iridium, osmium, rhodium and ruthenium) increased by 7% in 2018 as compared to that of 2017. South Africa, which accounted for 89% of global production accounted for most of the increase of other PGMs. Zimbabwe (5%) was the second leading producer.

To provide a generalised view of the development in various countries, the countrywise description, as sourced from the latest available publication of Minerals Yearbook 'USGS' 2017, is furnished below:

Canada

North American Palladium Ltd that produced 6,270 kg of palladium and 382 kg of platinum from its Lac des Isles Mine in Ontario registered a increase of 35% and 20%, respectively as compared to that of the production in 2016. The increase was as a result of resumption of full-time milling operations by the fourth quarter of 2017, with changes in mining methods alongwith upgrades effected to the structure and equipment at the mine.

Russia

PJSC MMC Norilsk Nickel, the dominant producer in Russia, produced 85,200 kg of palladium and 20,500 kg of platinum at its two production assets in Russia Kola MMC on the Kola Peninsula and the Polar Division on the Taymyr Peninsula. Production increased by 7% for palladium and 6% for platinum as compared with production in 2016.

Zimbabwe

Zimplats Holdings Ltd produced 7,270 kg of palladium and 8,720 kg of platinum at its mining operations in Zimbabwe in 2017—3% and 6% less respectively, than the production in 2016. The redevelopment of the Bimha Mine was on schedule and was expected to return to full capacity by the fourth quarter of 2018.

South Africa

The world's leading PGM producer, Anglo American Platinum Ltd (Amplats), reported primary equivalent refined production of 30,100 kg for

palladium and 41,700 kg for platinum in 2017– 6% and 17% less respectively as compared with the production in 2016. Amplats' Bokoni Mine was placed on care-and-maintenance status in the third quarter of 2017, and the jointly owned Mototolo Mine was temporarily closed from August to December for safety work.

In 2017, Glencore produced 778 kg of palladium and 1,280 kg of platinum, which reportedly showed a decrease of 31% and 29%, respectively.

Production at Implats' South African mining operations in 2017 was about 15,200 kg of palladium and 26,300 kg of platinum. The production essentially remained unchanged for palladium and showed a decrease of 5% for platinum as compared with the production in 2016.

FOREIGN TRADE

Exports

Exports of platinum alloys and related metals jumped substantially by about 26% to 937 kg valued at ` 219.74 crore in 2018-19 from 741 kg valued at `126.18 crore in the previous year. Exports were mainly to UK (76%), USA (16%) and Republic of Korea (5%). Exports in 2018-19 comprised of platinum (unwrought) at 394 kg and platinum (others) at 284 kg. During 2018-19, exports of other metals of platinum group were 258 kg as compared to 111 kg during the preceding year while that of platinum-powder were at only 1 kg as compared to nil in the previous year. Exports were solely to Kuwait (Tables- 4 to 9).

Imports

Imports of platinum alloys and related metal during 2018-19 decreased by 27% to 8,876 kg valued at ` 1,833 crore as compared to 12,099 kg valued at ` 2,271 crore in the previous year. Imports in 2018-19 comprised of platinum (powder, unwrought & others) at 4,859 kg, platinum (others) 2,228 kg and other metals of platinum group 1,789 kg. Imports of other metals of platinum group were mainly from UK (30%), Germany (22%), Japan (21%), South Africa (14%) and USA (9%). During 2018-19, imports of platinum-clad base (precious metals) decreased drastically by 80% to 5 kg as compared to 25 kg in the previous year. Import were mainly from Singapore (60%) and USA (40%). During 2018-19, imports of platinum powder were at 578 kg as compared to 917 kg in the preceding year. Imports were mainly from Germany (54%), South Africa (21%) and USA (20%) (Tables- 10 to 17).

Table – 4: Exports of Platinum Alloys & Related Metals: Total (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (``'000)	Qty (kg)	Value (``'000)
All Countries	**741**	**1261759**	**937**	**2197414**
UK	542	927156	711	1747741
USA	12	18983	152	291726
Korea, Rep. of	-	-	45	82753
Italy	5	8097	28	73051
Israel	++	281	++	1104
Kuwait	-	-	1	758
Germany	111	230480	++	98
Hong Kong	++	3	++	76
Singapore	26	59637	++	30
Malaysia	-	-	++	29
Other countries	45	17122	++	49

Figures rounded off

Table – 5 : Exports of Platinum (Unwrought)
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (``'000)	Qty (kg)	Value (``'000)
All Countries	**568**	**988409**	**394**	**738216**
UK	542	926997	235	450284
USA	++	388	118	211429
Korea, Rep. of	-	-	39	70747
Italy	-	-	2	4597
Israel	++	281	++	1052
Singapore	26	59620	++	30
Malaysia	-	-	++	29
Germany	-	-	++	19
China	-	-	++	14
Nepal	-	-	++	11
Other countries	++	1124	++	5

Figures rounded off

Table – 6 : Exports of Platinum (Others)
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (``'000)	Qty (kg)	Value (``'000)
All Countries	**62**	**42775**	**284**	**614380**
UK	++	155	221	469264
Italy	5	8097	26	68454
USA	12	18579	31	64568
Korea, Rep.of	-	-	6	12006
Hong Kong	-	-	++	76
Nepal	-	-	++	13
Mexico	44	15580	-	-
UAE	1	345	-	-
Kenya	++	12	-	-
Egypt	++	6	-	-

Figures rounded off

Table – 7 : Exports of Platinum (Powder)
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (``'000)	Qty (kg)	Value (``'000)
All Countries	-	-	**1**	**834**
Kuwait	-	-	1	758
Germany	-	-	++	64
Israel	-	-	++	13

Figures rounded off

Table – 8 : Exports of Other Metals of Platinum Group
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**111**	**230575**	**258**	**843984**
UK	++	4	255	828193
USA	++	16	3	15729
Israel	-	-	++	39
Germany	111	230479	++	15
Egypt	-	-	++	7
Ethiopia	++	58	-	-
Singapore	++	17	-	-

Figures rounded off

Table – 9 : Exports of Platinum-Clad Base/Precious Metal
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**12**	**682**	**++**	**254**
USA	-	-	++	191
Australia	-	-	++	63
Italy	10	403	-	-
Israel	++	149	-	-
Mauritius	1	72	-	-
New Zealand	1	57	-	-

Figures rounded off

Table – 10 : Imports of Platinum Alloys and Related Metals
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**12090**	**22710828**	**8876**	**18334592**
UK	2511	4999892	3453	8002430
South Africa	3597	7009793	1770	3720317
Germany	1453	3117556	1200	3073038
Japan	195	311892	620	1341858
USA	706	1025124	1115	1291904
Italy	496	701358	378	458731
Egypt	-	-	118	240429
Hong Kong	12	19386	29	43113
Switzerland	302	535506	19	38472
Czech Republic	18	40716	14	34209
Other countries	2800	4949605	160	90091

Figures rounded off

Table – 11 : Imports of Platinum (Powder, Unwrought & Others) (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**6803**	**13342861**	**4859**	**9548458**
UK	1218	2409590	1960	3887013
South Africa	2649	5362454	1216	2354525
Germany	707	1416952	810	1563463
USA	317	625034	478	946871
Japan	7	13598	227	460346
Italy	242	463945	81	159667
Egypt	-	-	25	54186
Hong Kong	9	16933	16	32314
Czech Republic	18	40716	13	31704
Switzerland	2	4176	16	31248
Other countries	1634	2989463	17	27121

Figures rounded off

Table – 12: Imports of Other Metals of Platinum Group (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**3795**	**7040352**	**1789**	**4998382**
UK	862	1782969	532	1730937
Germany	570	1289388	385	1508233
Japan	180	281362	382	855229
South Africa	830	1432128	246	587064
USA	219	199673	156	269475
Singapore	-	-	20	13441
Russia	786	1435645	15	10342
Hong Kong	2	113	12	10048
Switzerland	300	531271	3	7108
Canada	-	-	2	2625
Other countries	46	87803	36	3881

Figures rounded off

Table – 13: Imports of Platinum (Others) (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**1492**	**2327615**	**2228**	**3787752**
UK	431	807333	961	2384480
South Africa	118	215211	308	778729
Italy	236	190692	297	299064
Egypt	-	-	93	186243
USA	170	200418	481	75558
Japan	8	16933	11	26283
China	30	1153	50	20679
Spain	42	27481	16	13911
Germany	176	411216	5	1342
Hong Kong	1	2340	1	751
Other countries	280	454842	5	713

Figures rounded off

Table – 14 : Imports of Platinum-Clad (Rolled etc.) (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**25**	**5375**	**5**	**14391**
Singapore	-	-	3	8588
USA	4	2343	2	5146
Italy	1	214	++	634
UK	1	2735	++	24
Germany	19	83	-	-

Figures rounded off

Table – 15 : Imports of Platinum-Unwrought (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**5886**	**11488484**	**4281**	**8395459**
UK	1214	2402521	1960	3886974
South Africa	2173	4396191	1092	2106801
Germany	315	630417	495	950487
USA	303	594111	364	708797
Japan	7	13598	227	460346
Italy	211	400735	81	159667
Hong Kong	9	16933	16	32314
Czech Republic	18	40716	13	31704
Switzerland	2	4176	16	31248
UAE	2	5834	8	17424
Other countries	1632	2983253	9	9697

Figures rounded off

Table – 16: Imports of Platinum-Powder (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**917**	**1854377**	**578**	**1152999**
Germany	392	786535	315	612976
South Africa	476	966263	124	247724
USA	14	30923	114	238073
Egypt	-	-	25	54186
UK	4	7070	++	40
Australia	31	63210	-	-
Italy	++	376	-	-

Figures rounded off

Table – 17 : Imports of Platinum-Clad Base/Precious Metal (By Countries)

Country	2017-18 (P)		2018-19 (P)	
	Qty (kg)	Value (`'000)	Qty (kg)	Value (`'000)
All Countries	**25**	**5375**	**5**	**14391**
Singapore	-	-	3	8588
USA	4	2343	2	5146
Italy	1	214	++	634
UK	1	2735	++	24
Germany	19	83	-	-

Figures rounded off

FUTURE OUTLOOK

India is meeting its demand entirely by imports. The demand for PGEs is expected to touch 120 tonnes by 2025, as per the Report of the Sub-group for 12th Plan period.

As per PGM Market Report, May, 2018 of "Johnson Matthey Platinum Group Metals Service", there has been a decline in demand in 2017 due to sharp falls in Japanese investment buying and Chinese jewellery fabrications. Indian platinum jewellery demand is most likely to expand following successful industry marketing and campaigns to promote the purchase of platinum jewellery sets as wedding gift.