

Certified Reference Materials

Catalogue



About IPT

Founded in 1899, the Instituto de Pesquisas Tecnológicas do Estado de São Paulo (IPT) is one of Latin America's most established applied research institutions. With more than 120,000 m² of infrastructure and a highly qualified multidisciplinary team, the Institute operates in strategic areas such as metrology, advanced materials, energy, the environment and digital technologies. In 2025, it served more than 2,700 clients, issued more than 17,000 technical documents and was active in 269 municipalities in the state of São Paulo, 26 Brazilian states and 16 countries, consolidating its position as a national and international reference in applied science, technology and innovation.

Regulatory and Metrological Technologies (TRM)

The TRM unit is IPT's area dedicated to the reliability, traceability and conformity of measurements that support industrial competitiveness and the protection of society. With more than 8,400 m² of laboratories and the broadest accredited scope in the Brazilian Calibration Network (RBC), TRM serves more than 1,000 companies annually and issues more than 7,500 technical documents, including

calibration certificates, test reports and technical opinions. It develops references and measurement methods for sectors such as oil and gas, manufacturing, health, energy, agribusiness, mining, mobility, Industry 4.0 and smart cities.

Laboratório de Referências Metrológicas (LRM)

Part of TRM, it develops Certified Reference Materials for a variety of physical and chemical properties in natural and industrial matrices, and also provides Proficiency Testing Programs for several industry sectors.



The Ramos de Azevedo Monument, in front of the IPT campus, at the University of São Paulo.



Front view of the Laboratory building on the IPT campus

The Laboratory

The Laboratório de Referências Metrológicas (LRM) was established in 1975, with technical support from the National Institute of Standards and Technology (NIST), to develop physical and chemical metrological references for materials used by industry, universities and research centers. In 1977, it produced the first Brazilian reference materials and has since developed more than one hundred certified reference materials.

The materials are developed through rigorous preparation and characterization processes aimed at obtaining stable and homogeneous products, in accordance with ABNT NBR ISO 17034, ABNT NBR ISO/IEC 17025 and ABNT ISO Guide 35. Certified values are obtained using methods with direct traceability or by technical consensus through interlaboratory programs involving specialist laboratories. CRMs are used to calibrate analytical instruments, viscometers and densimeters, among others; to validate test methods; to demonstrate laboratory traceability and proficiency; and to resolve technical disputes.

LRM serves laboratories throughout Brazil and in several other countries, including the United States, Germany, France, India, South Korea and Japan.

Throughout its history, the laboratory has received support from FINEP, FAPESP and CNPq to modernize its infrastructure and expand its chemical quantification capability. In 2026, with support from FEHIDRO, it is implementing multi-quadrupole mass spectrometry and optimizing its clean area, seeking measurement capability at the

nanogram-per-kilogram level required by new reference materials for advanced industry and the most stringent environmental requirements.

In addition to reference materials, LRM provides interlaboratory proficiency testing programs (PTPs), conducted in accordance with ABNT NBR ISO/IEC 17043. Since 2012, programs have been offered for steels, lubricating oils, plastics and water, among other sectors. The laboratory is restructuring this activity with a view to accreditation by Cgcre, in

order to resume and expand the offer of programs to different industrial and academic sectors.

Certified Reference Materials



A certified reference material is a material that is sufficiently homogeneous and stable with respect to specified properties, accompanied by a certificate that assigns values to those properties with stated measurement uncertainty and established metrological traceability. It is an input that enables a laboratory to calibrate instruments, validate analytical methods and demonstrate the reliability of its results.

The CRMs produced by LRM are developed in accordance with ABNT NBR ISO 17034, together with ABNT ISO Guide 35 and ABNT NBR ISO/IEC 17025. The process includes preparation of the source material, homogeneity and stability studies, characterization using validated methods, and assignment of the certified value with its associated uncertainty.

The portfolio includes chemical-composition materials - carbon, low-alloy, stainless and tool steels; cast irons; ferroalloys; copper and its alloys; silicon metal; minerals and refractories - as well as materials for physical properties, with standards for kinematic viscosity, absolute viscosity and density.

LRM CRMs are currently present in several countries: Brazil · USA · United Kingdom · Germany · France · Spain · India · South Korea · Japan

Certified Reference Materials for Chemical Composition

- Carbon steels
- Low-alloy steels
- Stainless steels
- Tool steels
- Cast irons
- Ferroalloys
- Copper and its alloys
- Silicon metal
- Minerals
- Refractories

Laboratório de Referências Metrológicas
Tecnologias Regulatórias e Metrológicas
Instituto de Pesquisas Tecnológicas do Estado de São Paulo

Carbon steels

CHIPS · CHEMICAL COMPOSITION (%)

CRM	Grade	C	Si	Mn	P	S	Ni	Cu	Cr	Mo	Al soluble	Nb	B Total	Ti	V
IPT 11A	AISI 1020	0,205	0,03	0,439	0,009	0,011	0,079	0,013	0,121	0,01	0,153	–	–	–	(0,003)
IPT 13A	AISI 1060	0,573	0,26	0,723	0,011	0,014	0,065	0,076	0,098	0,018	0,027	–	–	–	–
IPT 14A	AISI 1040	0,415	0,292	0,699	0,029	0,036	0,104	0,278	0,100	0,029	(0,009)	–	–	–	–
IPT 39	AISI 1005	0,048	0,061	0,34	0,021	0,034	0,048	0,019	0,084	0,012	0,169	–	–	–	–
IPT 55	AISI 1080 modificado	0,837	0,24	0,923	0,023	0,027	0,174	0,187	0,215	0,099	0,093	0,061	–	–	–
IPT 58A	0,3%C	0,316	–	–	–	0,021	–	–	–	–	–	–	–	–	–
IPT 60A	0,7%C	0,715	–	–	–	0,012	–	–	–	–	–	–	–	–	–
IPT 71	~ SAE J403 10B40	0,406	0,541	1,04	0,017	0,025	0,085	0,125	0,174	0,018	0,038	–	0,0084	–	–
IPT 93	~ SAE J403 15B13	0,14	0,261	1,02	0,036	0,028	0,053	0,129	0,104	0,013	0,045	–	0,0022	0,034	–

DISCS · CHEMICAL COMPOSITION (%)

CRM	Grade	C	Si	Mn	P	S	Ni	Cu	Cr	Mo	Al total	Al soluble	Pb	Co	Ti	N	Nb
IPT 503	AISI 1045	0,456	0,218	0,682	0,027	0,027	0,063	0,129	0,160	0,020	0,018	–	0,008	0,006	0,0011	0,0082	–
IPT 504	AISI 1541	0,395	0,232	1,474	0,019	0,031	0,048	0,096	0,098	0,009	0,032	0,028	–	0,0077	0,0011	0,0078	(0,012)

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Low-alloy steels

CHIPS · CHEMICAL COMPOSITION (%)

CRM	Grade	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	Al solu- ble	Co	V	Nb	N	Ti	B	Sn	As
IPT 12A	AISI 8640	0,435	0,348	0,908	0,012	0,009	0,082	0,508	0,528	0,172	–	–	–	–	–	–	–	–	–	–
IPT 16A	AISI 8620	0,212	0,287	0,82	0,019	0,018	0,053	0,559	0,493	0,201	–	0,016	–	–	–	–	–	–	–	–
IPT 17A	AISI 4340	0,415	0,26	0,724	0,014	0,0210	0,074	1,76	0,82	0,259	–	–	0,039	–	–	–	–	–	–	–
IPT 29A	Ni-Cr-Mo	0,614	0,372	0,565	0,012	0,0076	0,012	0,794	0,845	0,276	–	0,028	–	0,08	–	0,0039	–	–	–	–
IPT 31	AISI 6150	0,497	0,146	0,794	0,021	0,009	0,251	0,106	1,15	–	(0,099)	0,087	–	0,25	–	–	–	–	–	–
IPT 33	AISI 5160	0,603	0,133	0,772	0,011	0,007	0,036	0,059	0,793	–	–	0,099	–	–	–	–	–	–	–	–
IPT 36	Cr-Mo-Al Nitalloy	0,315	0,291	0,43	0,016	0,0039	0,129	0,217	1,25	0,201	–	0,86	–	–	–	–	–	–	–	–
IPT 47	ASTM A588 Grade B	0,122	0,273	0,959	0,013	0,02	0,245	0,221	0,573	–	–	–	–	–	0,032	–	–	–	–	–
IPT 96	ASTM A242	0,109	0,286	0,845	0,017	0,0049	0,272	0,018	0,614	–	–	0,041	0,0048	(0,002)	0,0072	0,0092	(0,001)	–	–	–
IPT 97	WNR 1.7147	0,165	0,231	1,11	0,015	0,026	0,129	0,227	1,22	0,064	(0,035)	0,028	0,013	0,024	0,023	0,0119	(0,002)	0,0022	–	–
IPT 100	Cr-Ni-Mo-V	0,462	0,188	0,755	0,016	0,019	0,053	0,524	1,08	0,94	–	0,029	(0,006)	0,117	–	0,0075	(0,0012)	–	–	–
IPT 108	AISI 9260	0,598	1,96	0,861	0,028	0,02	0,121	0,052	0,133	0,017	–	0,019	0,006	–	–	–	0,004	–	(0,008)	(0,003)
IPT 142	AISI 8630	0,304	0,242	0,801	0,022	0,025	0,226	0,421	0,505	0,179	0,029	0,027	0,008	–	0,02	0,0133	–	–	–	–

DISCS · CHEMICAL COMPOSITION (%)

CRM	Grade	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	Co	V	Nb	Ti	Sn	As	N	B	Ca
IPT 500A	ASTM A242	0,107	0,842	0,016	0,0049	0,281	0,270	0,018	0,611	0,0018	0,046	0,0044	0,0029	0,0083	0,0015	0,0018	0,0020	0,0092	(0,0004)	(0,0025)
IPT 501	SAE 4130H	0,277	0,723	0,016	0,03	0,208	0,083	0,063	1,05	0,21	0,034	0,008	–	–	0,0015	0,008	–	0,0076	–	–
IPT 502	AISI 8620	0,21	0,823	0,018	0,026	0,198	0,121	0,408	0,485	0,155	0,024	0,0083	–	–	0,0016	–	–	0,0069	–	–

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Stainless steels

CHIPS · CHEMICAL COMPOSITION (%)

CRM	Grade	C	Si	Mn	P	S	Ni	Cu	Cr	Mo	N	Co	Al solu- ble	Al	W	V	Sn	Ti	Nb
IPT 22	AISI 440A	0,628	0,449	0,804	0,029	0,009	0,143	0,05	16,21	–	0,008	–	–	–	–	–	–	–	–
IPT 24A	AISI 316	0,048	0,51	1,53	0,035	0,02	11,12	0,32	17,37	2,47	(0,036)	(0,16)	–	–	–	–	–	–	–
IPT 26	AISI 420	0,201	0,306	0,713	0,022	0,012	0,413	0,029	13,69	0,070	–	–	–	–	–	–	–	–	–
IPT 98	~AISI 316Ti	0,05	0,26	1,88	0,042	0,016	11,01	0,292	16,75	1,92	0,0112	0,125	0,07	0,073	0,053	0,053	0,019	0,41	(0,007)

Tool steels

CHIPS · CHEMICAL COMPOSITION (%)

CRM	Grade	C	Si	Mn	P	S	Cu	Ni	Cr	V	Mo	W	Co	Al	Al soluble	Sn	Ti
IPT 50	AISI M2	0,916	0,326	0,28	0,031	0,015	0,091	0,33	4,49	2	5,54	6,4	0,26	–	–	–	–
IPT 67	W Nr. 1.3207	1,27	0,26	0,256	0,036	0,007	0,092	0,32	4,33	2,58	4,39	8,03	9,79	–	–	–	–
IPT 114	AISI H13 / DIN W Nr 1.2344	0,388	1,02	0,361	0,021	0,0023	0,064	0,165	5,2	0,89	1,29	0,174	0,018	–	0,028	(0,005)	(0,002)
IPT 117	W Nr. 1.2721	0,515	0,349	0,557	0,019	0,011	0,070	3,01	1,03	0,015	0,292	0,060	0,014	–	0,026	–	–
IPT 145	W Nr. 1.2714	0,558	0,259	0,716	0,016	0,011	0,051	1,61	1,14	0,094	0,494	(0,038)	0,024	0,023	0,021	–	–

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Cast irons

CHIPS · CHEMICAL COMPOSITION (%)

CRM	Grade	C total	Graphitic C	Si	Mn	P	S	Cu	Ni	Cr	Ti	Mo	V
IPT 49	White	2,11	–	0,78	0,272	0,012	0,019	0,040	0,021	0,020	–	–	–
IPT 75A	Alloyed gray (Ni Cr Mo Cu)	3,4	2,7	1,98	0,722	0,25	0,033	0,433	0,425	0,487	0,022	0,439	0,03

DISCS · CHEMICAL COMPOSITION (%)

CRM	Grade	C total	Si	Mn	P	S	Sn	Cu	Ni	Cr	Ti	Mo	Al	V
IPT 4302	White (4,3% C)	4,26	1,27	1,00	0,12	0,028	0,125	1,12	0,085	0,64	0,088	0,64	0,028	0,58

Note: IPT 4302 was characterized by several laboratories in a proficiency testing program; however, it was not certified in accordance with ISO 17034.

FILINGS FOR SPECIAL APPLICATIONS

CRM	Grade	C total	Graphitic C	Si	S	Special application
IPT 4301	Gray	2,99	2,53	1,62	0,053	This reference material is a gray cast iron prepared at IPT for use in tests to characterize the control of ferrous corrosion by water-soluble machining fluids. The material is supplied as filings with a particle size between 0,84 mm (retained on ABNT No. 20 sieve) and 1,0 mm (passing ABNT No. 18 sieve). Some elements in the material were characterized, and the values obtained are shown in the table alongside; however, it is not designated as a chemical-composition reference material.

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Ferroalloys

POWDERS · CHEMICAL COMPOSITION (%)

CRM	Type	Mn	Fe	C	P	S	Si	Cu	Cr	Ni
IPT 54	Fe-Mn	80,4	15,9	1,20	0,22	0,003	1,74	0,059	0,043	0,14
IPT 65	Fe-Cr Low C	0,128	17,9	0,051	0,006	0,017	0,71	(0,003)	71,2	0,077
IPT 70	Fe-Si	0,283	54,1	0,087	0,018	(0,006)	44,7	0,066	0,046	0,022

POWDERS · CHEMICAL COMPOSITION (%) (continued)

CRM	Type	Ti	Al	Ca	Mg	Co	V	Mo	Zn
IPT 54	Fe-Mn	-	-	-	-	(0,08)	(0,08)	(0,02)	(0,02)
IPT 65	Fe-Cr Low C	-	9,2	-	-	0,016	-	-	-
IPT 70	Fe-Si	0,018	0,21	0,16	0,016	-	-	-	-

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Copper and its alloys

CHIPS · CHEMICAL COMPOSITION (% and mg/kg)

CRM	Type	Cu (%)	Ag (%)	Pb (mg/kg)	Zn (mg/kg)	Fe (mg/kg)	Ni (mg/kg)	Sb (mg/kg)	As (mg/kg)
IPT 64	Pure copper	99,98	0,0010	0,6	(0,001)	4,5	1,8	(2)	(2)

CHIPS · CHEMICAL COMPOSITION (%)

CRM	Type	Cu	Sn	Pb	Zn	Fe	Ni	Sb	S	As	P	Cd	Al	Ag
IPT 10B	Bronze (85%Cu, 5%Sn, 5%Pb, 5%Zn)	85,2	4,61	4,74	4,73	0,211	0,33	0,114	0,068	0,019	0,003	-	-	-
IPT 74	Bronze (80%Cu, 3%Sn, 6%Pb, 10%Zn)	80,41	2,84	6,24	9,88	0,315	0,15	0,016	0,056	(0,002)	(0,002)	0,013	-	-
IPT 40	Brass 2,45 Pb	58,10	0,18	2,45	39,1	0,007	0,0012	0,023	-	-	-	0,049	0,010	(0,002)

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Silicon metal

POWDERS · CHEMICAL COMPOSITION (% and mg/kg)

CRM	Type	Fe (%)	Ca (%)	Al (%)	C (%)	S (%)	Mn (mg/kg)	Ti (mg/kg)	Mg (mg/kg)
IPT 135	Chemical grade	0,125	0,011	0,045	0,018	(0,002)	70	113	12

POWDERS · CHEMICAL COMPOSITION (mg/kg) (continued)

CRM	Type	P (mg/kg)	Cu (mg/kg)	Cr (mg/kg)	Ni (mg/kg)	V (mg/kg)	Pb (mg/kg)
IPT 135	Chemical grade	27	8	6	5	(3)	(2)

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Clays

POWDERS · CHEMICAL COMPOSITION (%)

CRM	Type / Origin	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	P ₂ O ₅	CaO	MgO	Na ₂ O	K ₂ O	Loss on ignition
IPT 32	Plastic clay (Saracuruna)	51,8	28,5	3,46	1,49	0,13	0,17	0,39	0,16	0,80	12,6
IPT 42	Clay (São Simão)	51,9	32,2	1,09	0,96	0,07	0,05	0,19	0,02	0,47	12,9

Feldspars

POWDERS · CHEMICAL COMPOSITION (%)

CRM	Type	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Loss on ignition
IPT 53	Potassic	65,8	18,3	0,13	0,013	0,27	0,05	2,5	12,1	0,072	0,51
IPT 72	Sodic	66,2	20,26	0,09	(0,005)	0,18	(0,022)	10,0	1,47	1,03	0,66

Fluorite

POWDERS · CHEMICAL COMPOSITION - Elements (%)

CRM	Origin	CaF ₂	SiO ₂	Fe ₂ O ₃
IPT 95	Criciúma - SC	85,4	8,3	0,36

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Bauxite

POWDER · CHEMICAL COMPOSITION (%)

CRM	Origin	Al ₂ O ₃	SiO ₂	Fe ₂ O ₃	P ₂ O ₅	TiO ₂	K ₂ O	ZnO	MnO	V ₂ O ₅	ZrO ₂	Loss on ignition	Al O available	SiO reactive
IPT 131	Poços de Caldas	54,1	0,78	11,5	0,15	1,77	0,022	0,013	0,31	0,042	0,35	30,0	(52,0)	(0,4)

POWDER · CHEMICAL COMPOSITION (%) (continued)

CRM	Origin	SO ₃	Cr ₂ O ₃	CaO	Ga ₂ O ₃	Ge	F	C organic	MgO	Be
IPT 131	Poços de Caldas	(0,07)	(0,004)	(0,007)	(0,012)	(0,01)	(0,1)	(0,08)	(0,002)	(0,0002)

Phosphate concentrate

POWDER · CHEMICAL COMPOSITION (%)

CRM	Origin	P ₂ O ₅	CaO	SiO ₂	F	Fe ₂ O ₃	Al ₂ O ₃ total	Al ₂ O ₃ soluble	MgO soluble	Na ₂ O soluble	K ₂ O total	K ₂ O soluble	SrO soluble	MnO
IPT 18B	Jacupiranga	35,7	52,6	1,15	1,33	0,21	0,35	(0,31)	(1,65)	(0,14)	0,23	(0,21)	0,48	(0,26)

Refractories

POWDER • CHEMICAL COMPOSITION (%)

CRM	Type	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	ZrO ₂	SrO	CaO	MgO	MnO	Li ₂ O	Na ₂ O	K ₂ O	P ₂ O ₅	Loss on ignition
IPT 51	Silico-aluminous	55,0	40,3	1,19	2,19	0,070	-	0,06	0,20	-	0,018	0,09	0,69	0,09	0,16
IPT 57	Aluminous	24,3	71,5	1,25	1,19	0,20	0,009	0,05	0,13	-	0,008	0,35	0,83	0,054	0,20
IPT 63	Siliceous	96,28	0,48	0,52	0,030	(0,002)	-	2,21	0,18	0,008	(0,0005)	0,013	0,043	0,013	0,17

CONVENTIONS: () informational value - similar composition - RM characterized material, not certified - N.D. not determined or not applicable.

Certified Reference Materials for Physical Properties

- Viscosity
- Density

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Kinematic viscosity

TYPICAL VALUES (mm²/s)

CRM	20,0 °C	25 °C	37,8 °C	40 °C	50 °C	98,9 °C	100 °C
IPT 76	4,6	4,1	3,1	3,0	2,5	1,3	1,2
IPT 77	10,9	9,2	6,3	6,0	4,6	2,0	1,9
IPT 78	20,9	17,1	10,8	10,0	7,0	2,7	2,6
IPT 79	48,8	38,3	22,3	20,0	14,5	4,4	4,3
IPT 80	94	71,5	38,6	35,0	22,7	6,1	6,0
IPT 81	130	96,9	50,3	45,0	29,9	7,1	6,9
IPT 82	180	135	67,1	60,0	38,7	8,5	8,3
IPT 83	330	240	110	100	61,6	11,8	11,5
IPT 84	530	375	170	150	91,2	15,8	15,4
IPT 85	740	510	225	200	115	18,6	18,0
IPT 86	1195	815	340	300	170	24,1	23,4
IPT 87	1680	1130	458	400	220	28,9	28,0
IPT 88	2240	1490	592	510	280	34,7	33,5
IPT 89	4960	3260	1260	1000	585	66,5	64,1
IPT 90	10925	7060	2600	2000	1140	110	105
IPT 91	22190	14175	5070	4000	2140	175	170
IPT 92	45190	28610	9980	8000	4070	295	285
IPT 99	129000	80565	27100	23000	10625	665	635

Approximate values. Refer to the current lot certificate for exact values.

Dynamic viscosity

TYPICAL VALUES (mPa.s)

CRM	20,0 °C	25 °C	37,8 °C	40 °C	50 °C	98,9 °C	100 °C
IPT 76	3,6	3,2	2,4	2,3	1,9	0,92	0,91
IPT 77	9,1	7,7	5,2	4,9	3,8	1,5	1,4
IPT 78	17,7	14,4	9,0	8,4	6,2	2,2	2,1
IPT 79	41,6	32,6	18,8	17,3	12,1	3,5	3,4
IPT 80	80,9	61,3	32,8	29,8	19,9	4,9	4,8
IPT 81	110	83,4	63,4	38,7	25,2	5,8	5,6
IPT 82	160	115	57,4	51,5	32,8	6,9	6,7
IPT 83	290	205	96,3	85,7	52,4	9,7	9,4
IPT 84	470	330	150	130	79,0	13,8	13,2
IPT 85	655	450	200	175	100	15,6	15,1
IPT 86	1070	725	300	265	150	20,4	19,8
IPT 87	1505	1010	405	350	195	24,6	23,8
IPT 88	2015	1330	525	455	245	29,6	28,5
IPT 89	4315	2830	1080	930	500	54,9	52,9
IPT 90	9590	6180	2260	1930	985	90,8	87,2
IPT 91	19595	12480	4430	3760	1850	148	141
IPT 92	40180	25360	8775	7425	3555	250	240
IPT 99	115700	72065	24050	20220	9360	570	540

Approximate values. Refer to the current lot certificate for exact values.

Density

TYPICAL VALUES (g/cm³)

CRM	Description	Density at 20 °C (g/cm ³)
IPT 9200	Mineral oil	0,8792

Instituto de Pesquisas Tecnológicas



An institution made of people.

The IPT team together - the community that sustains decades of scientific metrology in Brazil

More information

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