



Elastic Properties of Pt, Rh, Ir and their Alloys

The Platinum Group Metals (PGMs) can be used at extremely high temperatures under severe corrosive conditions and high mechanical loads. They have high melting points and excellent chemical stability. In addition, platinum and its alloys in particular are very resistant to oxidation.

For the design of components from these materials, the knowledge of the elastic properties Young's modulus E , modulus of rigidity G and Poisson's ratio ν as a function of temperature is very important. These are measured by means of a resonance method^[1].

Young's modulus provides information on the stiffness of the material, for example under the influence of thermal expansion effects.

The modulus of rigidity describes the stiffness of the material under the influence of shear stress. If the material is extended in one direction, it contracts in another direction. The relationship of the extension and contraction is known as Poisson's ratio ν . The property ν_D is measured directly, whereas $\nu_{E/G}$ is calculated from the E and G moduli.

^[1] Platinum Metals Review, 2001, 45, (2), pp.74-82

Elastic Properties

Material	Temperature [°C]	Young's modulus [GPa]	ν_D	Modulus of rigidity [GPa]	$\nu_{E/G}$
Pt	25	164.6	0.396	54.2	0.518
	400	153.3	0.401	51.1	0.500
	800	137.8	0.396	46.6	0.479
Rh	25	372.4	0.266	151.7	0.227
	400	332.1	0.267	134.2	0.237
	800	291.0	0.287	116.2	0.252
	1000	271.5	0.296	107.3	0.265
	1200	246.9	0.296	–	–
Pt-10%Rh	25	212.6	0.365	78.0	0.363
	400	197.9	0.372	72.1	0.372
	800	179.2	0.379	65.2	0.374
	1000	169.7	0.381	–	–
	1200	–	–	–	–
Pt-20%Rh	25	245.9	0.342	91.6	0.342
	400	224.7	0.351	83.3	0.349
	800	201.0	0.359	74.1	0.356
	1000	189.8	0.362	69.8	0.360
	1200	179.2	0.380	–	–
Pt-30%Rh	25	277.7	0.324	104.8	0.325
	400	251.0	0.334	94.0	0.335
	800	222.1	0.345	82.7	0.343
	1000	209.3	0.350	77.5	0.350
	1200	195.4	0.358	–	–
Ir	25	525.5	0.254	218.2	0.204
	400	483.6	0.261	199.4	0.213
	800	439.9	0.275	179.7	0.224
	1000	417.5	0.281	170.3	0.226
	1200	394.4	0.286	–	–
Pt-10%Ir	25	202.3	0.378	73.4	0.378
	400	188.3	0.382	68.1	0.382
	800	170.7	0.389	58.1	–
	1000	162.2	0.396	–	–
	1200	150.8	0.393	–	–
Pt-20%Ir	25	233.3	0.368	85.5	0.364
	400	214.3	0.371	78.2	0.370
	800	192.3	0.384	70.1	0.372
	1000	182.5	0.386	66.2	0.378
	1200	171.1	0.386	–	–
Pt-30%Ir	25	263.3	0.346	97.5	0.350
	400	240.8	0.354	88.6	0.359
	800	216.1	0.359	79.3	0.363
	1000	204.5	0.368	74.7	0.369
	1200	192.2	0.372	–	–

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