



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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