High Temperature Erosion Resistant Composites

Powder Metallurgy Group of DMRL is working on copper infiltrated tungsten composites for different missile components such as jet vanes, throat nozzles and throat inserts that are used as altitude controls in thrusters. The composites are prepared by sintering of pure tungsten powders in order to obtain a controlled level of interconnected porosity followed by infiltration of molten copper into the porous mass. The above process requires optimisation of numerous parameters such as initial tungsten purity/particle size, green density of tungsten compact, sintering temperature, sintering time and sintered density, purity of copper, infiltration temperature, infiltration time and machining parameters etc. So, R&D efforts were directed to arrive at the optimised parameters to get defect free W-Cu composite. The manufacture process involves using graphite dies for infiltration and refractory metal powder for packing. All other parameters were standardised. The process achieved pore free composite with good machinability and significantly improved yield.

The W-Cu composite has shown excellent erosion resistance and has helped in achieving consistent chamber pressure for 50 sec of firing duration. The typical room temperature mechanical properties of the W-Cu composite are as follows:-

S No.	Properties	Specification
1	Density	16.0 ± 1 g/cc
2	Hardness	170 ± 30 VHN
3	Compressive Strength	1000 ± 200 MPa
4	Tensile Strength	600 ± 100 MPa

Application areas

The new process is useful in defence applications such as jet vanes, throat nozzles and throat inserts, which are used as altitude controls in thrusters of various missiles as well as the process could be used for civilian applications such as electrical contacts, resistance welding contacts, Electricals discharge machining (EDM) electrodes and porous emitters.