

Surface Modification of Tungsten Particles for Space application

S. Deshpande, K.E. Rea, S.C. Kuiry,
S. O'Dell* and S. Seal.

Advanced Materials Processing and Analysis
Center (AMPAC), and Department of
Mechanical, Materials and Aerospace
Engineering (MMAE), University of Central
Florida, Room #381, Eng. 1, 4000 Central
Florida Blvd., Orlando, Fl 32816.

* Plasma Process Inc., Huntsville, Al

Electroless rhenium (Re) coating of tungsten (W) particles is demonstrated in the present investigation. Addition of rhenium into tungsten matrix improves mechanical properties of tungsten such as low temperature ductility, high temperature strength, creep resistance and recrystallization temperature as shown in figure 1. [1,2]. Electroless deposition Re on W particles with successful reduction of potassium perrhanate and elimination of conventional sensitizations and activation steps is reported. The coated W particles are extensively characterized by scanning electron microscopy (SEM), Auger Electron Spectroscopy (AES), X-ray photoelectron Spectroscopy (XPS) Focused Ion Beam (FIB) and Secondary Ion Mass Spectroscopy (SIMS). Figure 2 shows SEM micrograph of uniformly coated tungsten particles. Relative uniform and continuous coating thickness of ~ 300 nm is obtained under given coating conditions. The possible mechanism of electroless Re coating of W particles is reported. These coated tungsten particles found wide applications such as rocket engine chamber, blades of aero engines and turbine blades.

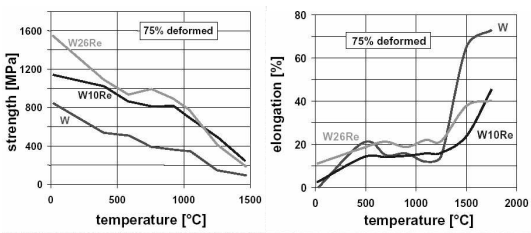
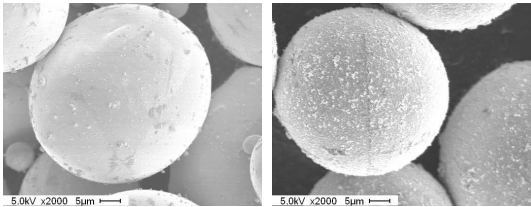


Fig 1. Re into W matrix improve its mechanical properties [1] .



(a) (b)
Fig 2. Scanning Electron Microscopy (SEM) micrograph showing tungsten particles (a) uncoated; (b) coated.

References

1. I. Smid, R. German , “Sintering and shaping of refractory metals”, sintering '03, 15-17 Sept. 2003.
2. H.P. Gao, R.H. Zee, “Effect of Rhenium on creep resistance in tungsten alloys”, J. of Material Sci. letter, 20 (2001) 885-887.