“Design and Processing of Refractory Metals for Thin Film Electronic Applications”

ABSTRACT

Refractory metals such as tantalum and molybdenum are often thought of for their high temperature mechanical properties. However, based on their chemical, physical and electrical properties, there are numerous room temperature applications in the electronics industry. Some examples include tantalum thin films that are applied as diffusion barriers in integrated circuits and molybdenum thin films applied as diffusion barriers and electrodes in the flat panel and touch screen displays of most LCD televisions, tablets and smartphones.

Sputtering is a common method of generating thin films of refractory metals. Integrated circuit manufacturers are constantly pushing to produce tantalum thin films that are thinner and more uniform in thickness. The sputtering behavior of tantalum is linked to its uniformity of microstructure and texture. It falls back to the sputtering target material producer to develop processing methods that improve uniformity. For this work, experimental processing methods were modeled, tested and analytically verified that resulted in targets with more consistent sputtering performance.

For molybdenum thin films, etching compatibility between different film layers is a key characteristic. Alloy chemistry is often manipulated to enhance this property. The materials science challenge is then to develop large-scale thermo-mechanical processing methods for alloys developed for their chemical behavior rather than mechanical properties. Several examples will be presented on the processing methods to produce sputtering targets from such unique alloys.

BIOSKETCH

Dr. Mike Stawovy has been a Senior Research and Development Manager in the Fabricated Products Division of H.C. Starck for 7 years. In addition to his administrative responsibilities, he leads product development projects on molybdenum and tungsten-based materials for application in medical, aerospace, defense, thermal management, furnace, chemical processing and electronics applications. Prior to H.C. Starck, Dr. Stawovy was an Advanced Technology Engineering Manager with Aerojet Rocketdyne for 10 years. He is a member of TMS, ASM, and APMI. Dr. Stawovy received three degrees (B.S., M.S., and PhD) in Materials Science from Virginia Tech. He received his PhD under the outstanding supervision of Dr. Alex Aning.