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Linking erosion and sputter performance of a rotatable Mo target to microstructure and properties of the deposited thin films

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Abstract

The use of Mo in large area thin film deposition includes back contact layers for thin film solar cells as well as diffusion barriers and source/drain electrodes in microelectronics and relies on its excellent thermal stability and chemical inertness as well as low electrical resistivity. A constant high quality of sputter deposited thin films during the entire target lifetime is of vital importance for these applications. Thus, this study addresses the sputter performance, i.e. changes of current, voltage and arc rate, recorded during erosion of a rotatable Mo target as well as the quality of thin films deposited at different erosion stages. The enhanced target erosion and the thus reduced target wall thickness cause an increase of the magnetic field strength in front of the target and yield a slightly reduced voltage and increased current. Increased arc rates could be related to venting the vacuum chamber during interruptions in target erosion which were needed for thin film depositions. Both, microstructure and electrical resistivity of the films deposited are widely unaffected by the progressing target erosion. In contrast, different substrate carrier oscillation modes determine film topography, stress and electrical resistivity. The end of target life is determined by the pronounced sputter grooves formed at both ends of the rotatable target due to the shape of the permanent magnetic field at the turnarounds rather than changes in the quality of the films deposited.

Keywords:

Sputtering; thin films; molybdenum; target life; sputter performance