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Titanium nitride: Overview of the material and the emission Mössbauer spectroscopy results

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Titanium nitride (TiN) belongs to the transition metal nitrides exhibiting metallic behavior in the visible and near-IR ranges, chemical stability, high melting temperature, and tunable optical properties. As an extremely hard material with high thermal and chemical stability, low electrical and thermal resistivity, TiN thin films have found many applications in the microelectronics industry. They have also been proposed as a promising alternative plasmonic material.

TiN thin films can be synthesized by many different deposition methods. Magnetron sputtering has been proved to be a successful technique and promoted to an industrial scale for many years. Especially, the recent version of high-power impulse magnetron sputtering (HiPIMS) makes the growth of high density, metallic-like ultra-thin TiN at room temperature possible. Perfect TiN possesses face centered cubic structure. However, non-stoichiometry and possible structural defects may exist in the TiN thin films grown by magnetron sputtering. Recently, a unique static magnetic and dynamic electromagnetic behavior in TiN/C composites driven by defect engineering was reported.

In this presentation, we employed emission Mössbauer Spectroscopy (e-MS) following implantation of 57Mn to study TiN thin films prepared with magnetron sputtering. The high sensitivity of this technique makes it especially useful to correlate or elucidate the possible magnetic properties owing to the structural defects or non-stoichiometry of the as-grown TiN thin film.

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