MS36-O4

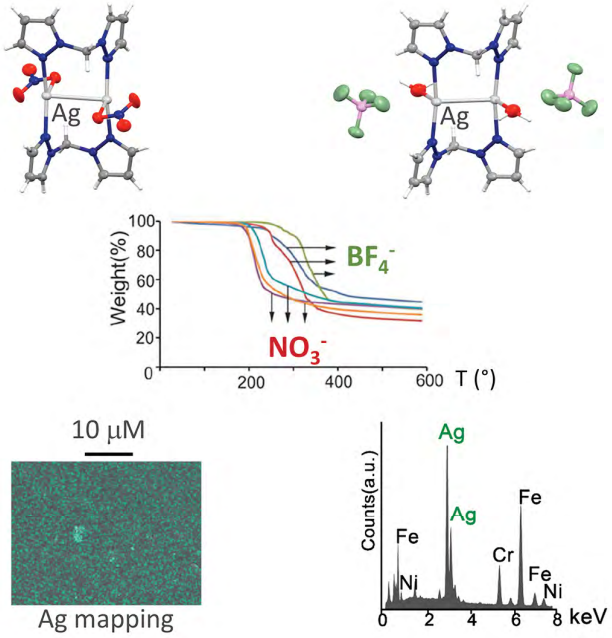
## Silver(i) complexes as molecularly-engineered lubricants

Luciano Marchio'[1], Irene Bassanetti[2], Massimiliano Delferro[3], Tobin Marks[4]

1. Department of Chemistry, Life Sciences, Environmental Sustainability, Parma, Italy
2. Department of Materials Science, University of Milano Bicocca, Milano, Italy
3. Argonne National Laboratory, Argonne, United States of America
4. Department of Chemistry, Northwestern University, Evanston, United States of America

**email: marchio@unipr.it**

The use of soft metal deposition for lubrication of sliding materials operating from room to extreme temperature is a field of remarkable interest. Applicative fields are in high speed machinery, advanced heat engine and steel or ceramic industries. Tribological studies of soft metallic layers have been conducted since 1950s and there is a vast literature discussing the use of silver as lubricant material [1]. One of the main problems when using precursors for in silver deposition is the purity of the final layer, since it can be contaminated with P, B, C, and other elements [2, 3]. In this work, we present a series of silver complexes that are able to generate silver layers of high purity. In particular, we considered two classes of nitrogen donor ligands, namely bis-pyrazoles and pyridine-pyrazoles, and two different counterions, $NO_3^-$ and $BF_4^-$, which are able to yield neutral and ionic complexes, respectively. The TGA profiles of the neutral complexes with the nitrate counter-ion show a sharp single decomposition step in the range 210-260 °C. Powder X-Ray analysis on TGA residues confirmed the presence of pure silver residues. Silver complexes were then deposited on the 52100 stainless steel with the spin-coating technique, and silver layers were produced upon heating at 300 °C. The silver layers were analyzed using powder X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM). The silver deposition on the 52100 stainless steel after treatment with Military grade 15W-40 engine oil containing various amounts of silver complexes provided fully flooded lubrication between the pin and disk. We will discuss the structural properties of the complexes that are functional to the silver deposition performances.




**Keywords: silver complexes, deposition, anti-wear**