GALLIUM-FREE MICROMECHANICAL SAMPLE PREPARATION FROM ECAP-ED ALLUMINIUM

Martin Sláma, TESCAN ORSAY HOLDING,a.s.
martin.slama@tescan.com
Petr Klímek, TESCAN ORSAY HOLDING,a.s.
Manuel Bornhoefft, TESCAN ORSAY HOLDING,a.s.
Jiří Dluhoš, TESCAN ORSAY HOLDING,a.s.
Hana Tesařová, TESCAN ORSAY HOLDING,a.s.
Jaromír Kopeček, Institute of Physics Czech Academy of Sciences

Key Words: Xe plasma, FIB-SEM, micro-compression, in-situ

Focused ion beam scanning electron microscopes (FIB-SEM) enable high precision site-specific material removal with practically no restriction on sample composition. Depending on the ion source (e.g. Ga+, Xe+), the rate of material removal differs significantly. In general, the design of Xe+ source allows using high ion beam currents that can be up to a few µA while maintaining beam quality and performance. However, the most relevant feature of Xe ions for this study is their non-metallic and inert nature which prevents any chemical interaction with the target material and formation of unwanted metallic compounds that alter the original properties of the sample that is being analyzed.

As some materials such as Al, Cu and Zn are sensitive to Ga ions, Xe+ ion milling can be a good asset for many FIB applications that involve working with these materials. This can be considered as a significant advantage over Ga ion source FIBs especially in microanalysis and nano-mechanical characterization.
In this work we demonstrate the process of micro-compression pillar preparation with Ga+ and Xe+ FIB and show the advantages offered by the Xe+ plasma FIB. Indicate the influence of gallium implantation on Al materials, Describe the effect of gallium on properties of micron-range grains of aluminum sample treated by the ECAP method via different methods.

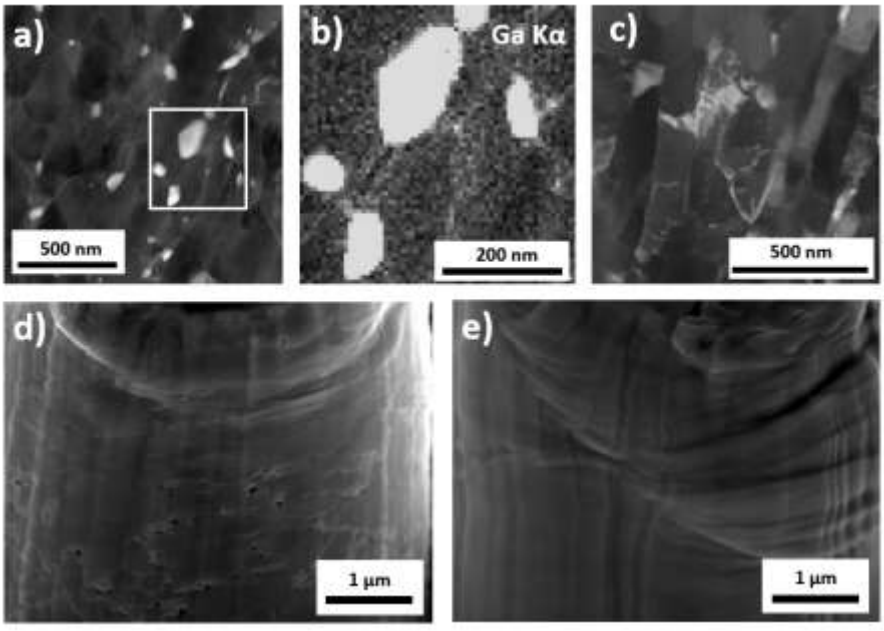

Figure 1 – Comparison of sample prepared by Ga FIB and Xe FIB. TEM lamella prepared by a) Ga FIB, shows significant Ga precipitation on grain boundaries b) EDS maps confirms Ga presence. c)TEM lamella prepared by Xe FIB shows no artefacts.Behavior of structure after compression on d) micropillar prepared by Ga FIB and e) Xe FIB.