Type of presentation: Poster

IT-13-P-1686 Focused ion beam sample preparation for atom probe tomography

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In recent times nanostructured multicomponent materials for which spatial distribution of chemical elements is crucial have been widely adopted. The most acceptable method for these materials is atom probe tomography, which allows identifying atom nature and its position in the volume of interest providing 3D imaging with sub-nanometer resolution. During material researching by tomographic atom probe the evaporation of atoms from the sample surface takes place in the process of high electric field. For the achieving of true information the main requirements are preferred for sample geometry: needle-shaped, tip radios, uniform circular cross-section, etc. The focused ion beam sample preparation permits to meet the before-mentioned needs in the optimum way. Now we describe existing FIB-based needle preparation technique (“lift-out”) from particle-reinforced materials for atom probe tomography. This procedure includes following stages: protective layer deposition onto the region of interest (ROI); milling of two regular cross section patterns on both sides of the ROI; the tilt of the stage and cut the lamella almost free from the bulk sample. Then the preparation is proceeded with using in-situ micromanipulator: it is inserted to the ROI; the lamella is attached to the probe using ion beam assisted Pt deposition and cut completely; the lamella is then transferred to a pre-prepared micropost. The next stage includes the lamella attaching (in preferred orientation) to the micropost and milling to detach from the micromanipulator. The final step is thinning of the made sample in order to sharpen its tip to aimed parameters and processing of the needle with low-energy ion beam to remove amorphous layer.
The advantage of chosen method of samples preparation for atom probe tomography is an opportunity to both orient them in parallel with initial surface and cut the sample from the need thickness.

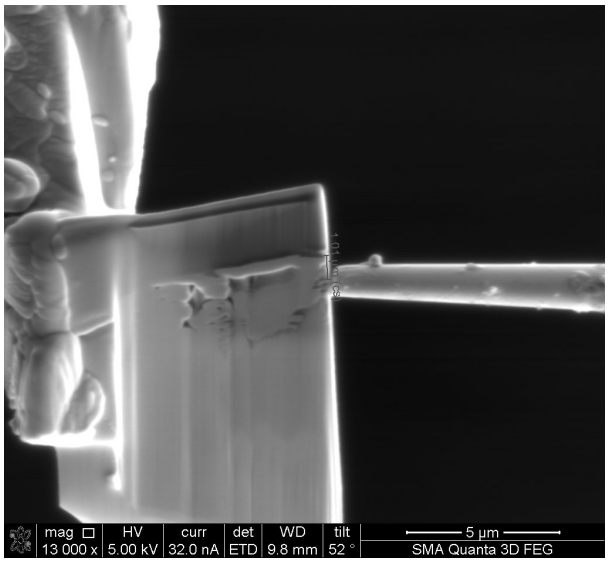

Fig. 1: SEM micrographs (Quanta 3D FEG) of lamella, attached to micromanipulator and maneuvered to the micropost

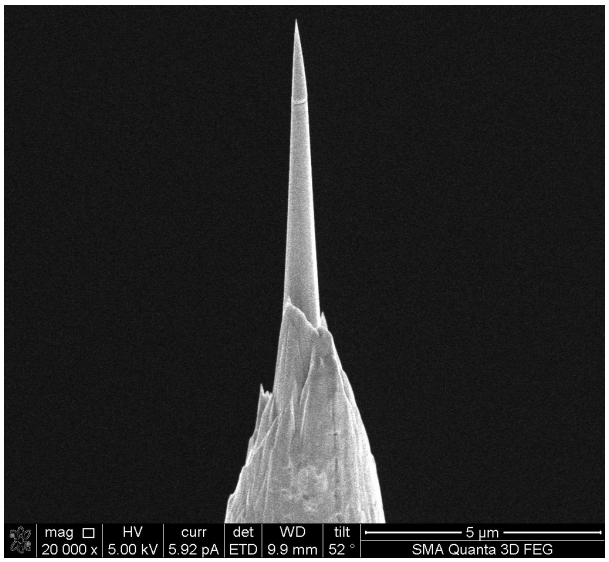

Fig. 2: SEM micrographs of work piece attached to the micropost

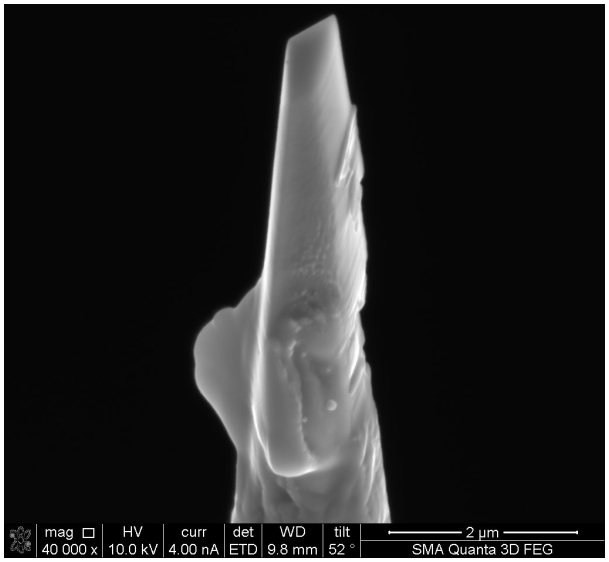

Fig. 3: SEM micrographs of the needle during initial thinning

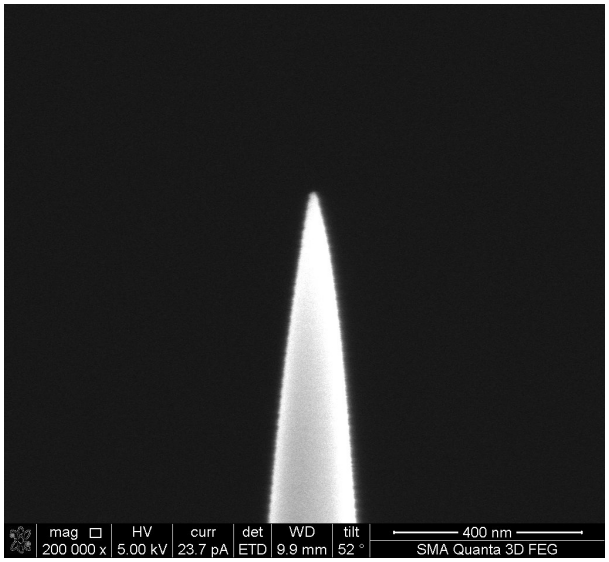

Fig. 4: SEM micrographs of the needle after final thinning