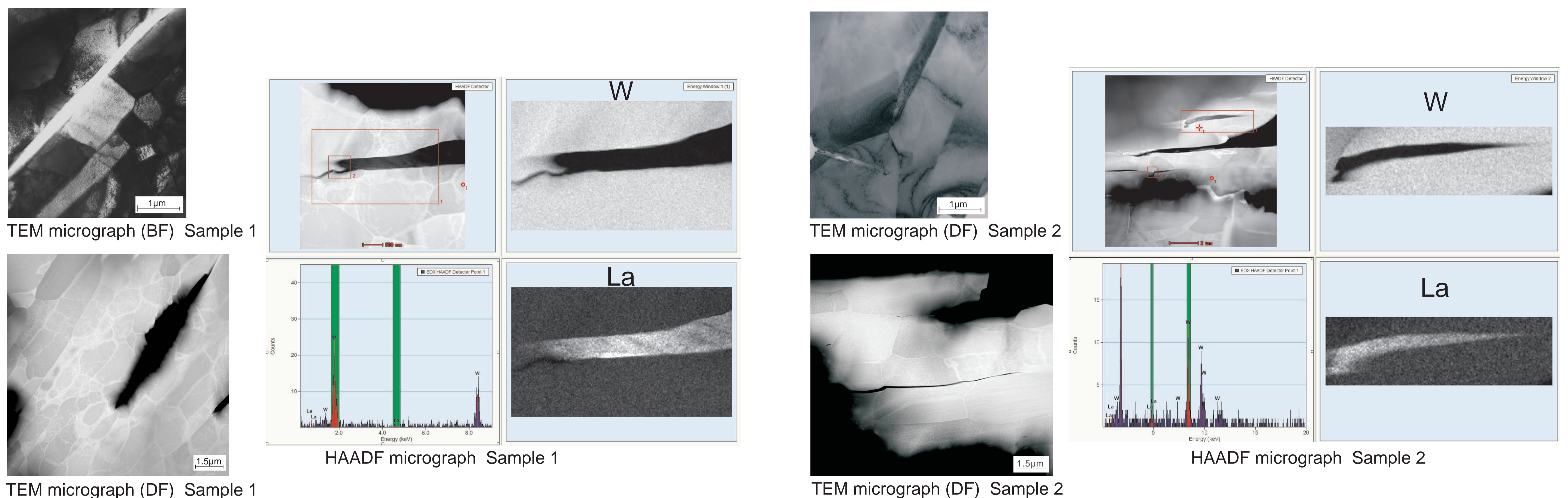


# Microstructure analysis of tungsten materials produced by different fabrication routes

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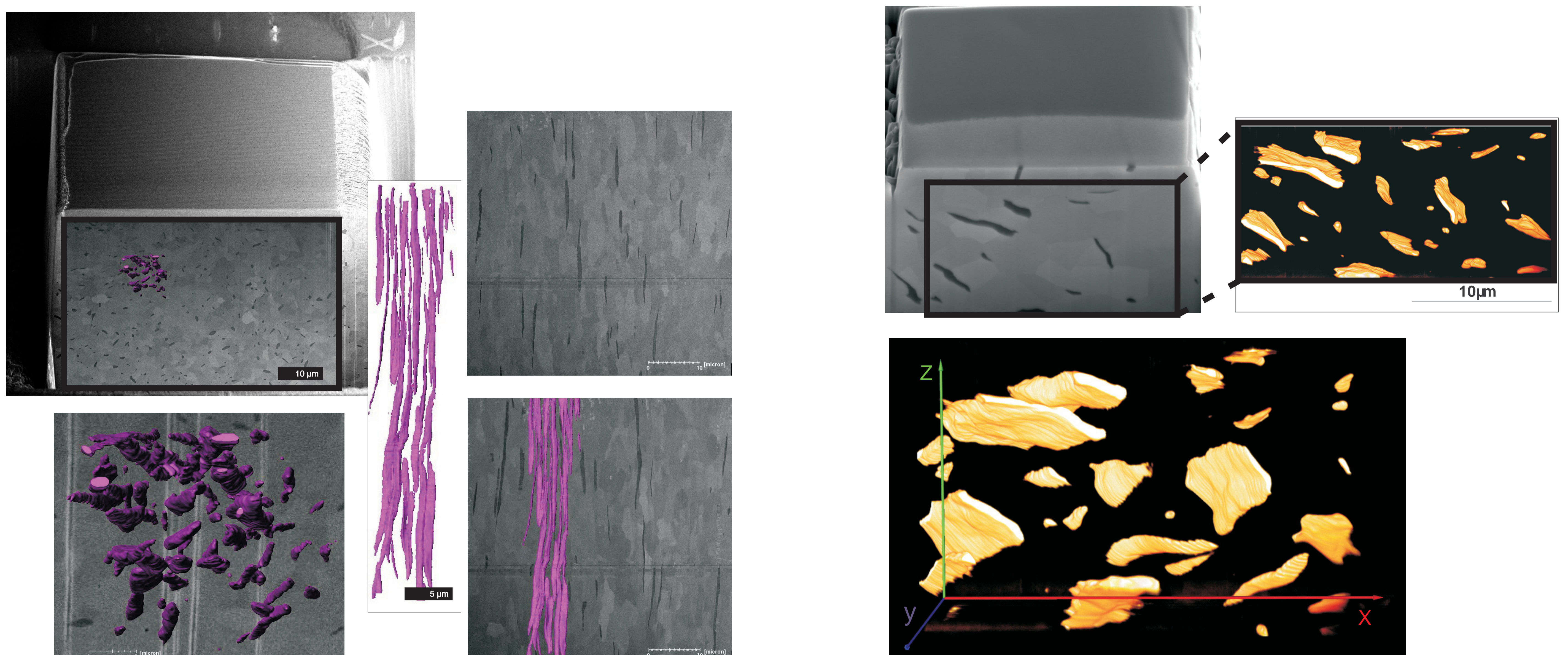
## Microstructural and analytical investigation using transmission electron microscope (TEM)

Investigations are carried out on two different production batches of tungsten composite half-finished product with 1% lanthanum oxide ( $W - 1\% La_2O_3$ ). The grain sizes in both materials measured by TEM and HAADF methods vary from 0.5 to  $5\mu m$  (Sample 1) and from 0.5 to  $8\mu m$  (Sample 2). Grains mostly show an elongated shape. Partial dislocations are existing inside grains. Holes in the samples are results of the electro-chemical preparation with the TENUPO 5 system. Analytical TEM investigations by 2D EDX mappings show lanthanum in separated lanthanum oxide particles only. Elementary lanthanum could not be detected along grain boundaries or inside tungsten grains.



## Microstructural investigation using a focused ion beam (FIB) system

Questions about the shape and variation of the lanthanum oxide particles in tungsten are answered clearly by 3D visualization. Slices have been produced using a FIB "Slice & View" technique and were processed in Amira® for surface rendering after precise alignment using fixed crosses. Visualized oxide dispersion particles in investigated half-finished products of  $W - 1\% La_2O_3$  show a different structure, depending on different fabrication routes: Sample 1 (rolled rod) - nearly a spicular structure and Sample 2 (swagged rod) - platelet shaped particles.



Sample 1 - SEM image and 3D visualization of lanthanum oxide particles with a needle structure in a tungsten matrix, sliced area of about  $60 \times 35 \times 50 \mu m^3$ . In this refractory alloy lanthanum oxide particles have nearly a spicular structure and 3D visualization clearly indicates a considerable fraction of the aligned particles longer than  $20 \mu m$ .

Sample 2 - SEM image and 3D visualization of lanthanum oxide particles with sheet-like structure in a tungsten matrix, sliced area of about  $20 \times 10 \times 15 \mu m^3$ . The difference in the particle structure of both samples results from significant deviations of the production process.