

# Creating TEM Samples and Evaluating the Thermal Stability of Nanocrystalline Tungsten and Tungsten-Titanium

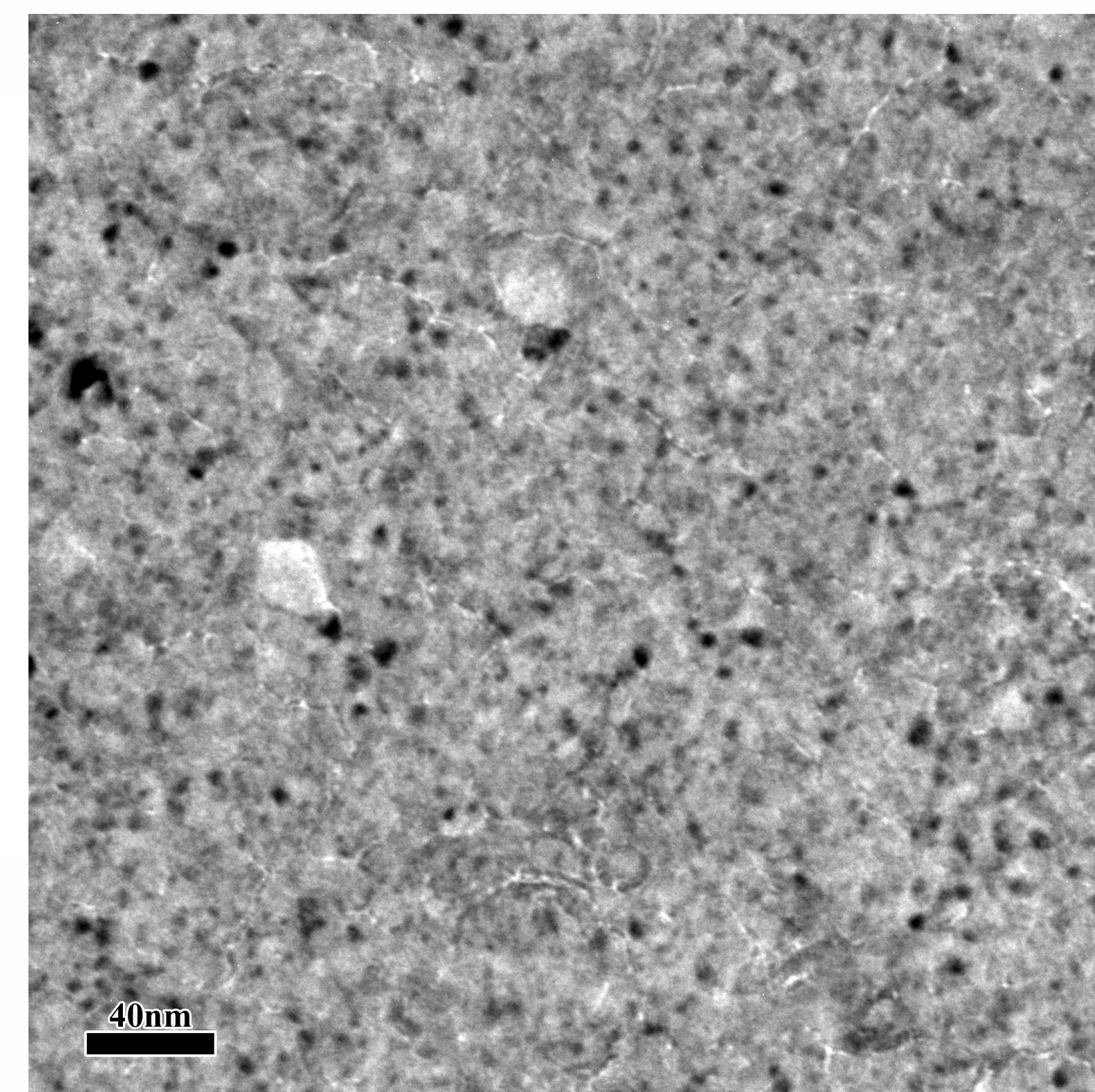
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## Purpose

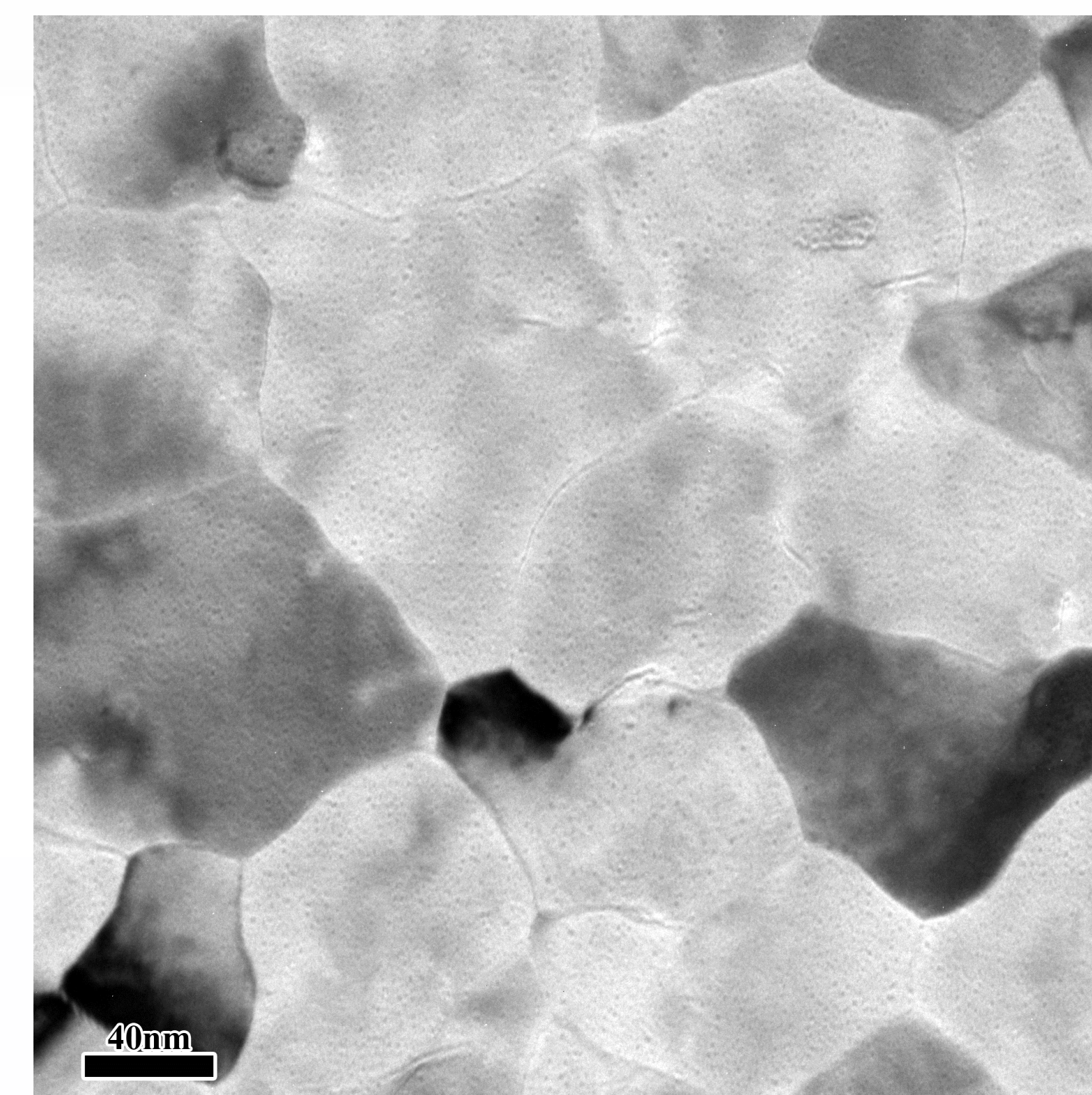
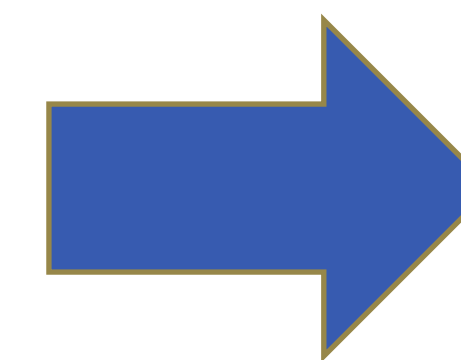
- To test nanocrystalline tungsten and tungsten-titanium resistance to high heat and radiation
- To find ways to control or limit the microstructural evolution that occurs when tungsten is annealed or irradiated

## Experiments

- Tungsten was annealed *in situ* to 1000° C inside the TEM



5.50 nm

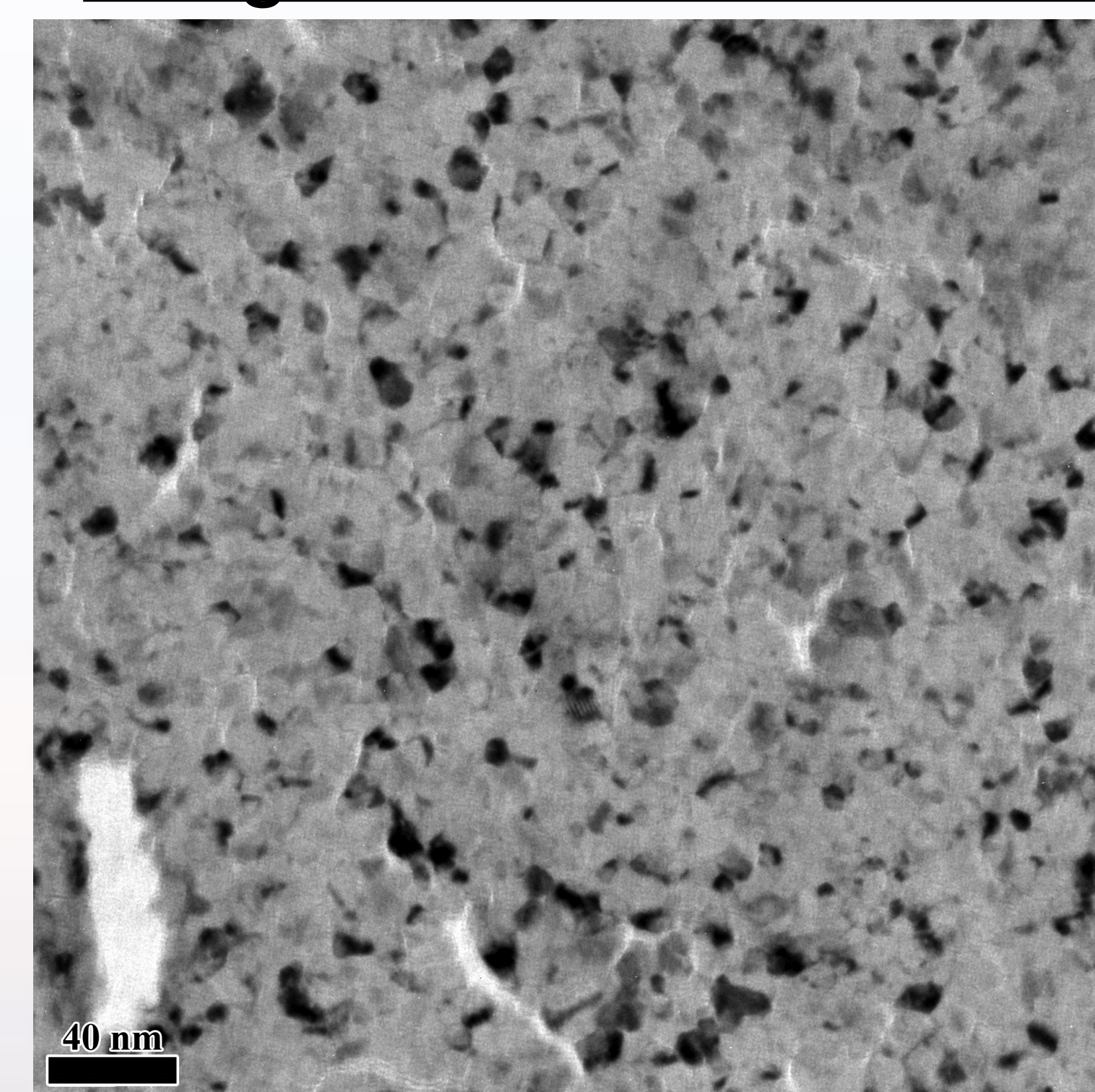


66.84 nm

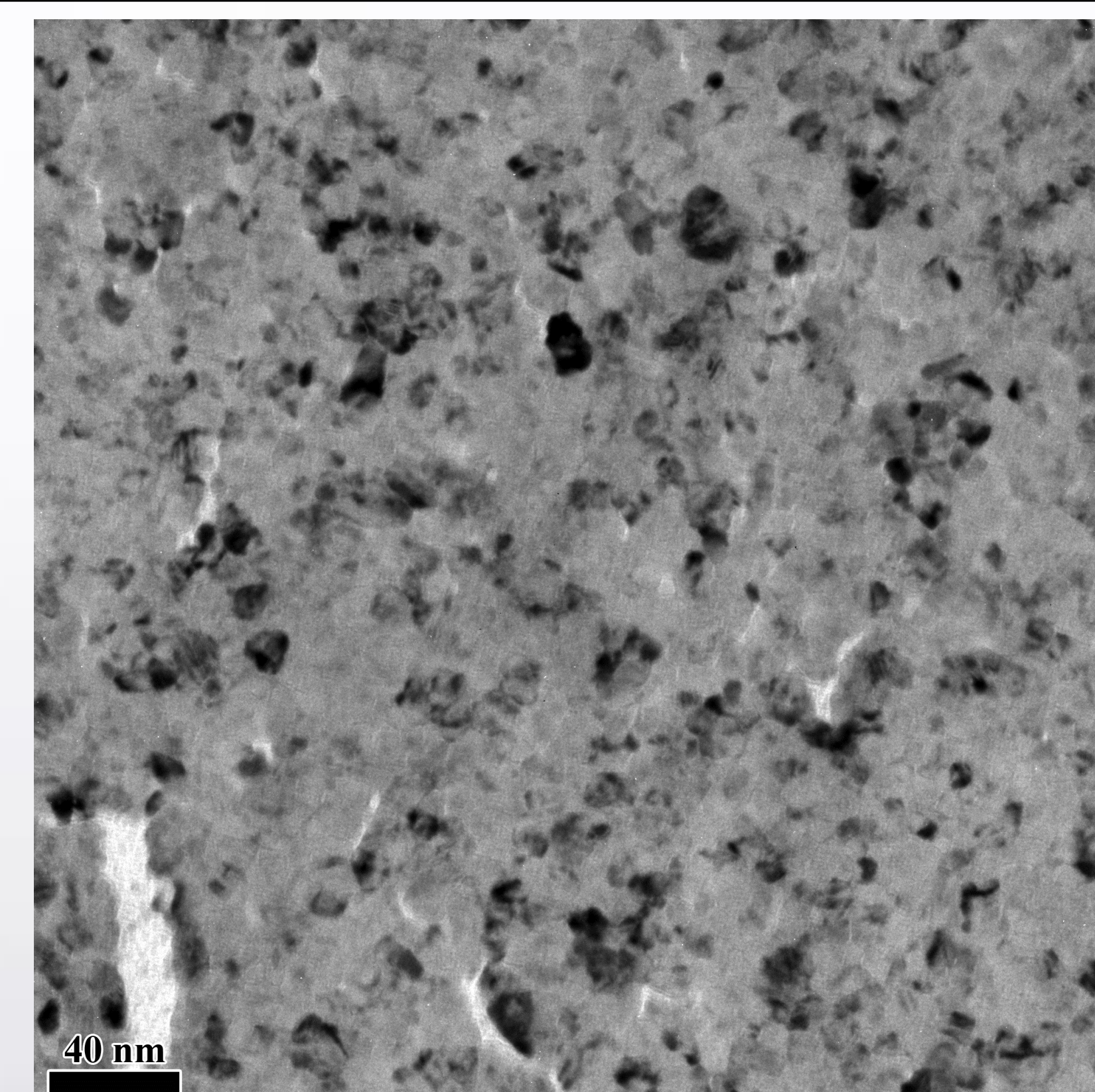
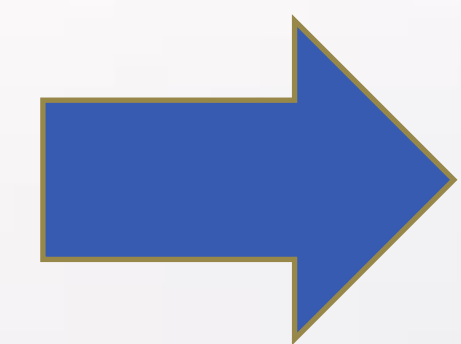
- The pure W exhibited a relatively high abnormal grain growth

The pure W exhibited over an 1100% increase in grain size.

- Tungsten-titanium was annealed *in situ* to 1000° C inside the TEM



10.41 nm



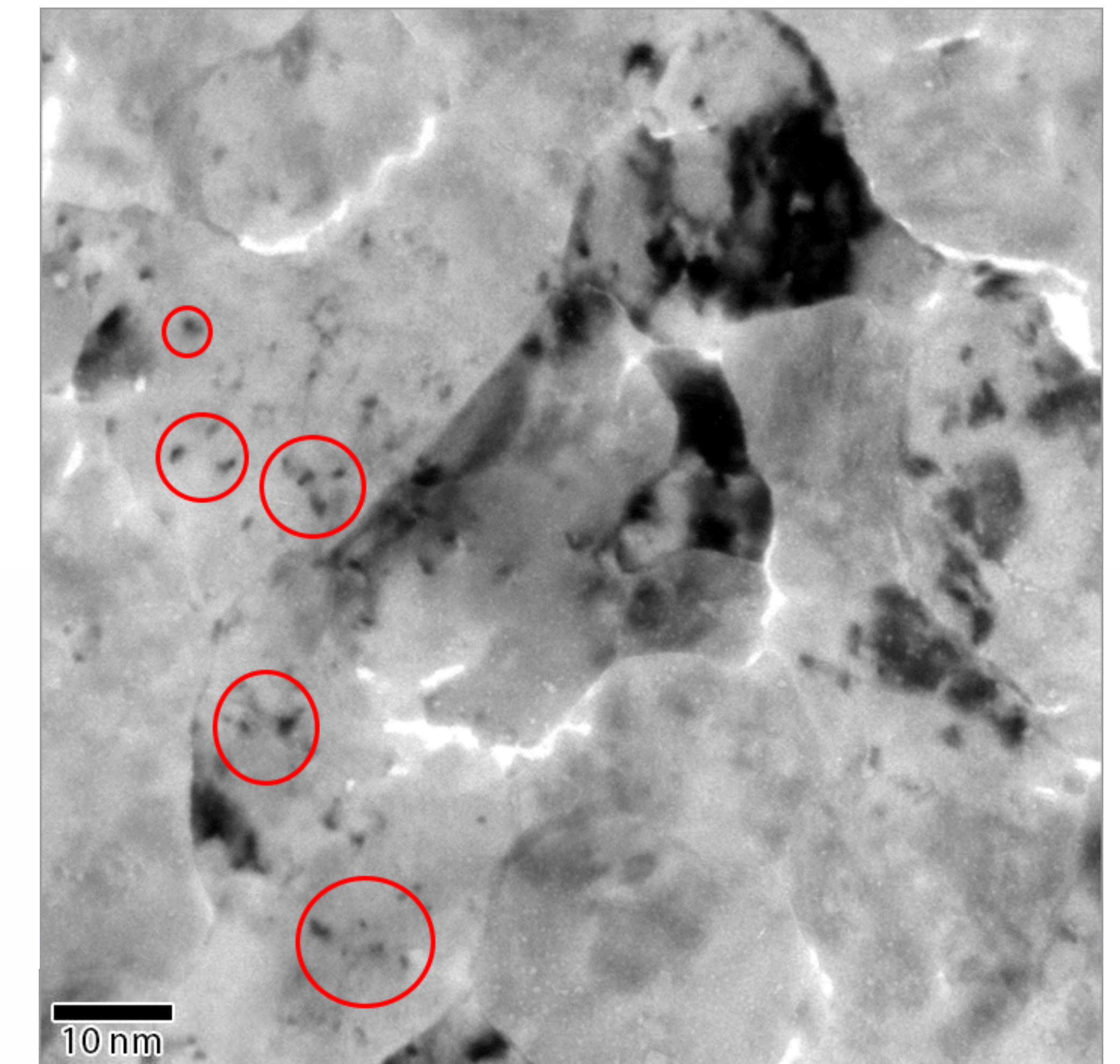
12.43 nm

- Alloying with Ti hindered the abnormal grain growth seen in pure W

The grain size of W-Ti increased by approximately 19%

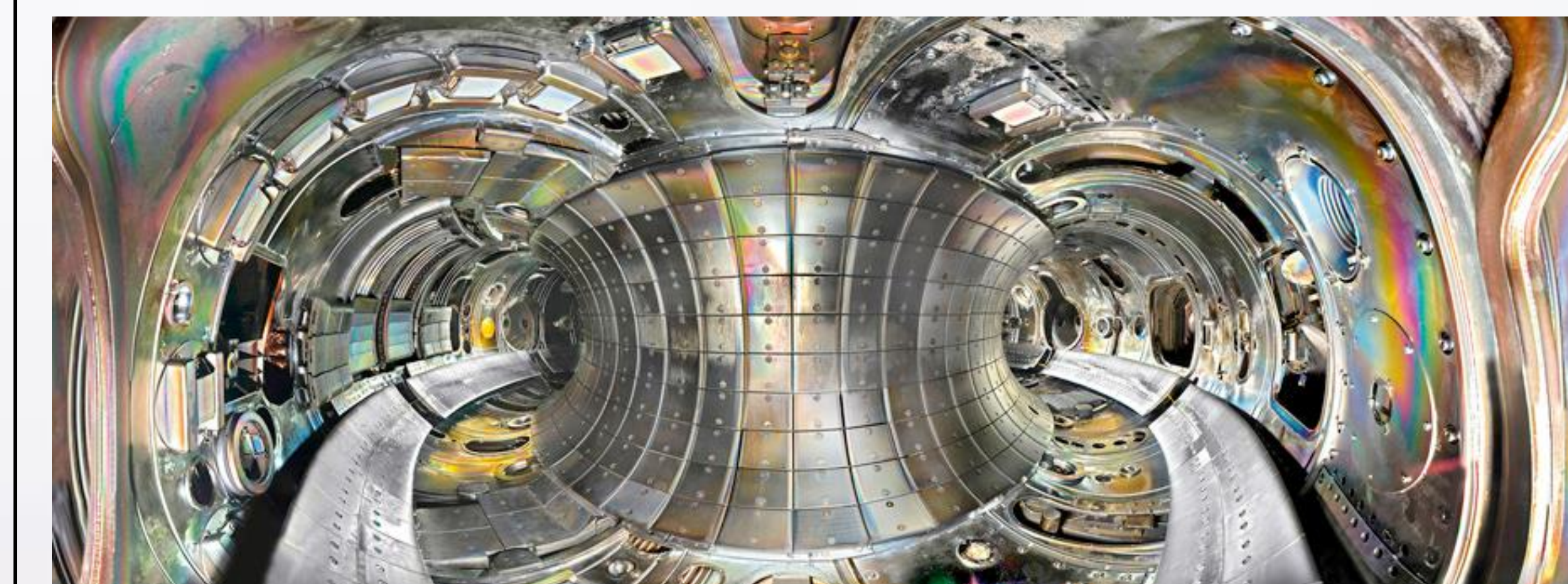
## Future Work

- Future work will determine the radiation stability of W-Ti



This sample of pure, W illustrates the defects (circled) produced by self-ion irradiation.

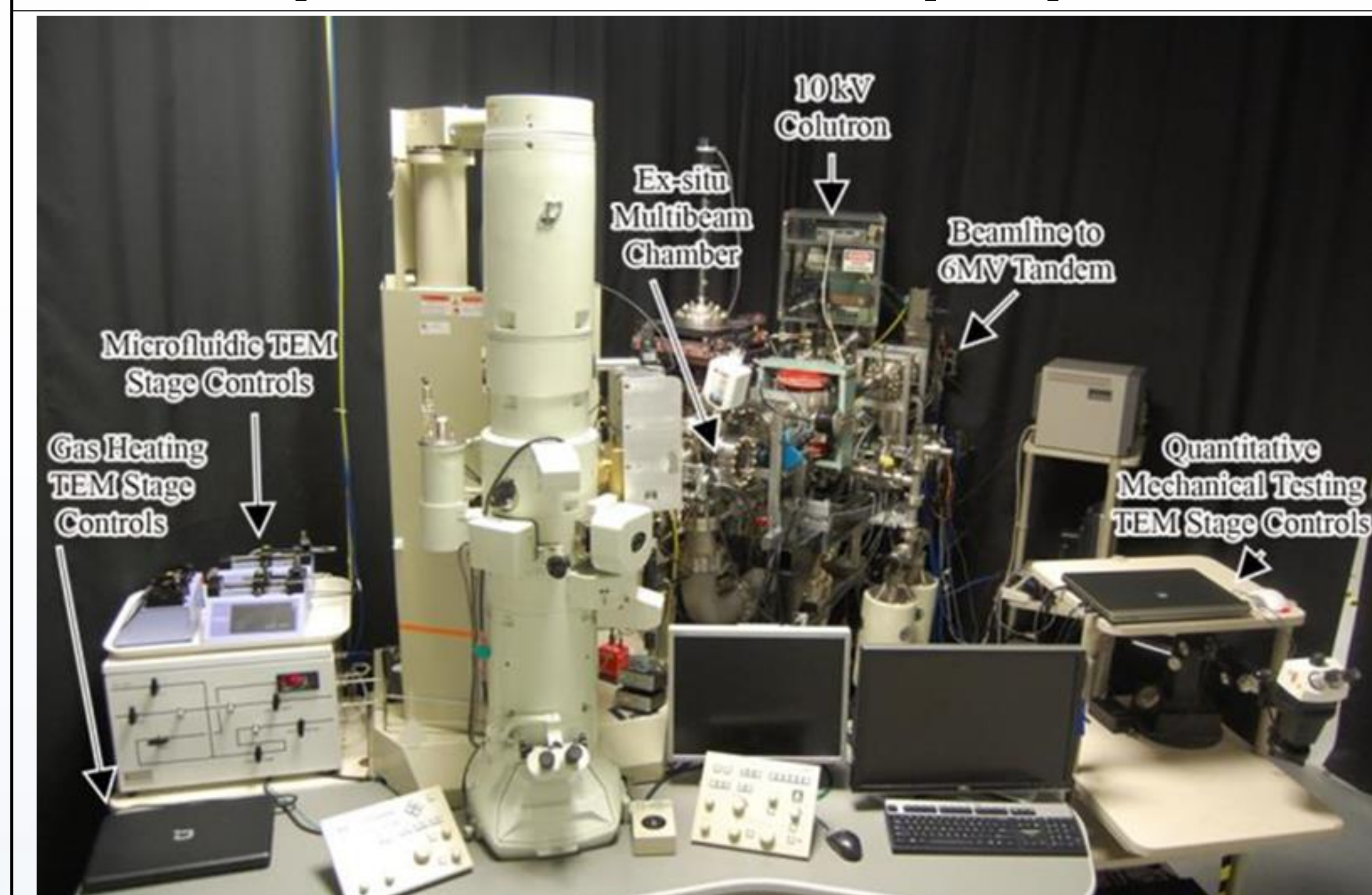
## Conclusions



Via: www.siemens.com

- Alloyed nanocrystalline W has the potential for use in next-generation nuclear reactors
- W-Ti has increased thermal stability compared to pure W

## Samples and Equipment



Top: Sandia's *in situ* TEM (I<sup>3</sup>TEM)  
 Left: The HVE EN tandem used to accelerate the W<sup>4+</sup> ions.

- 20 nm-thick, sputter-deposited samples of W, and W-Ti (15 at. %)
- Self-ion irradiated with 3 MeV W<sup>4+</sup>

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