

Thermal diffuse scattering effect observed in complex system Nb₁₆W₁₈O₉₄ grain boundaries.

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It is well known that the atoms in a crystal vibrate thermally around their equilibrium position. The scattering from the displaced atoms gives a diffuse intensity distribution and this effect is known as thermal diffuse scattering (TDS). In a high resolution HAADF-STEM image, the contrast of an atomic column is obtained as the integrated intensity over exposure time [1,2], since the atom in the column vibrate thermally and scatter electrons incoherently as TDS. Therefore, the electrons scattered from an atomic column depend on the atom species and also of the changing in the periodicity of the crystal because the lattice dynamics of a crystal is a combination of the lattice vibrations and atomic fluctuations [3].

In this work we recorded the changing in the thermal diffuse scattering intensity distribution on the complex Nb₁₆W₁₈O₉₄ oxide through the atomic resolution annular dark field STEM micrograph in the grain boundaries of the crystals using a 2010 JEM FAsTem microscope operated at 200keV using a large camera length L. We map by ADF-STEM the change in thermal diffuse scattering intensity distribution on several grain boundaries of the complex oxide and we obtained experimental evidence that the contribution of the thermal diffusely scattered electrons to the image in the borders of the crystal is the dominant scattering effect at large angles.

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[4] This work was financially supported by CUDI-CONACyT grant.