On the distribution of ruthenium in nanostructured WO_3 synthesized by the Pechini method

POSTER_P5.5 - Inorganic Materials and Metals

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Ruthenium-doped tungsten trioxide (Ru:WO_3) is a promising candidate for photocatalytic green ammonia synthesis due to its visible-light activity and potential to enhance charge carrier separation. In this study, nanostructured Ru:WO_3 powders were synthesized via the Pechini method. The main objective is to determine the spatial distribution of Ru in the material - whether it is incorporated into the bulk crystal lattice, segregated at grain boundaries, or enriched at the surface. Structural and compositional analyses were performed using X-ray diffraction with Rietveld refinement, X-ray photoelectron spectroscopy (XPS), and UV Diffusive Reflectance Spectroscopy (DRS). To quantify the surface-accessible Ru fraction, we applied selective alkaline lixiviation[1], and estimated the surface excess by normalising the extracted dopant content with specific surface areas obtained by the BET method. Preliminary results suggest that Ru is only partially incorporated into the WO_3 lattice, with a considerable fraction segregating to interfacial regions. This segregation is consistent with the thermodynamic tendency of dopants to reduce the system's free energy by concentrating at high-energy sites. The location of Ru is expected to significantly influence the material's photocatalytic performance. Ongoing photocatalytic tests under simulated solar irradiation and N_2 atmosphere[2] aim to correlate Ru distribution with ammonia synthesis efficiency.

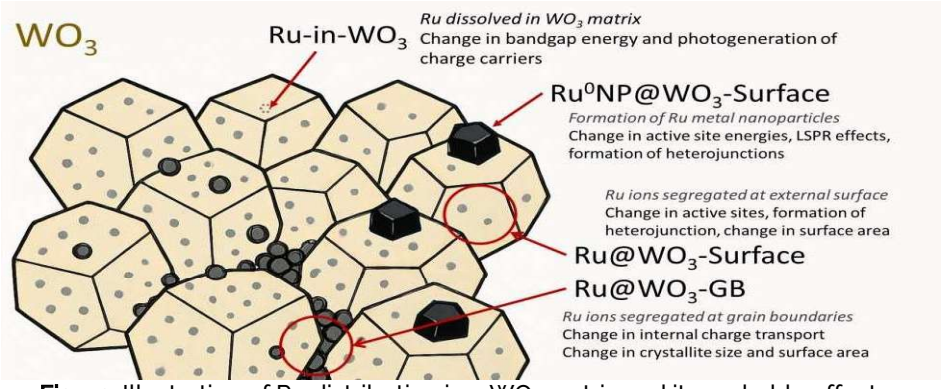

Figure: Illustration of Ru distribution in a WO_3 matrix and its probable effects

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References

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