Identification of Photocatalytically Active Surface Sites on Layered Transition Metal Sulfides

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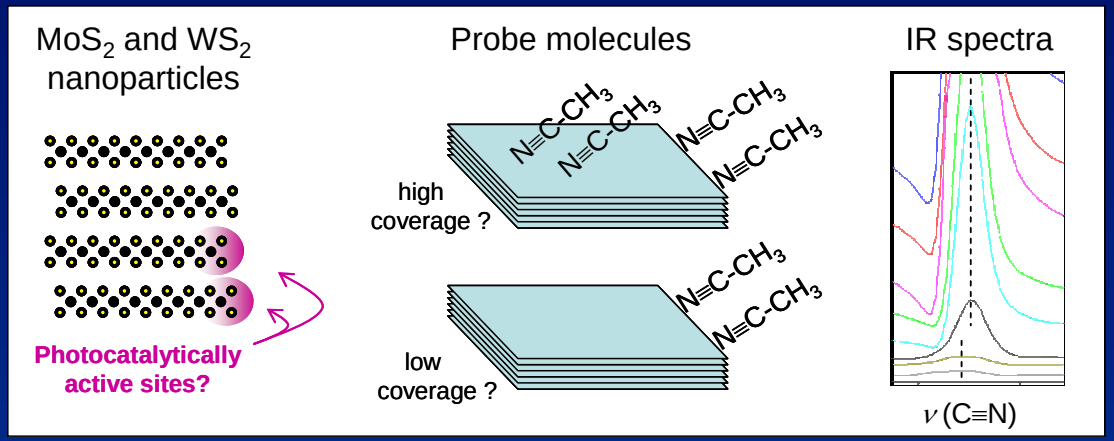
Atomically layered sulfides, MoS_2 and WS_2, can exhibit photocatalytic properties when dispersed on a nanometer scale. This holds potential for their use in the degradation of toxic chemicals using solar energy. Current hypothesis: photochemical processes are initiated mainly at the very edges of the atomic layers. The desired approach is to study how organic molecules adsorb on specific surface sites, e.g. edges vs. basal planes, and to monitor their chemical transformations induced by light.



MoS_2 and WS_2 nanoparticles previously synthesized by a surfactant-free method were used in the adsorption studies involving small probe molecules, such as acetonitrile. A special high-vacuum setup has been constructed for infrared spectroscopy on powdered samples. At the lowest coverages, we can observe the signal in the infrared spectra originating from a minority species, possibly acetonitrile adsorbed on the edge sites. This assignment is a subject of current studies.

Other sulfide structures of interest for future infrared adsorption studies:

- exfoliated 2-D sheets
- MoS_2 nanotubes made from oxide precursors