Scaling research: From photoelectron-ion coincidences to photocatalytic solar hydrogen production

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Solar energy harvesting and the clean energy transition in general are thematic research topics receiving a lot of attention today. For example, the understanding of catalytic processes in the time domain and intermediate state level urges the development of fundamental research tools for imaging and characterisation towards chemically, temporally and spatially resolved in-situ and operando methods. In the present we provide an overview on the physics lead hydrogen research at the University of Oulu and on the lates advancements in photocatalytic hydrogen production aka solar hydrogen as well as methodology development in the field of catalysis and materials sciences. Examples are given on the use and development of synchrotron based and laboratory scale techniques (PEEM, APXPS, TAP) in the characterisation of novel nanoscale catalytic systems. Focus of the presentation is on analytical tools development in integration of advanced mass-spectroscopy and gas-phase electron spectroscopy with low-pressure steady-state and transient kinetic measurements. Examples are given on identification of isomeric-selective experiments and isomer discrimination of catalytic process during DME conversion.

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[1]M. Babayan, E. Redekop, E. Kokkonen, U. Olsbye, M. Huttula, S. Urpelainen, "*PEPICO analysis of catalytic reactor effluents towards quantitative isomer discrimination: DME conversion over a ZSM-5 zeolite*", Journal of Synchrotron Radiation (4) 841-850 (2024).

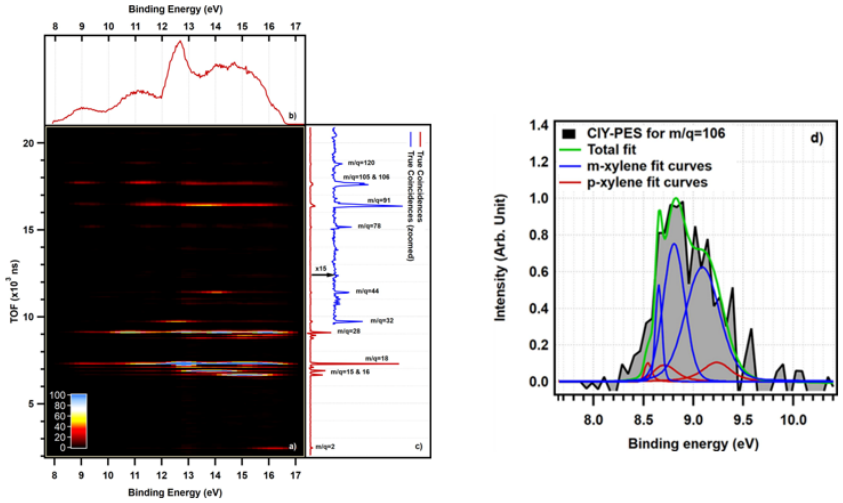

Figure 1. Isomer selective spectroscopy of xylene