Active metal- and alloy-based oxidation catalysts from laser synthesis of surfactant-free colloidal nanoparticles in liquid.

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The scalable, surfactant-free laser synthesis of catalysts has been shown to complement conventional preparation methods, especially by enabling independent studies of the catalytic activity in terms of nanoparticle purity, functional properties (size, morphology, oxidation state), and material design (multi-elemental composition) as summarized in Fig. 1.[1-3] Preadjusted nanoparticle properties are maintained due to subsequent nano integration onto support materials enabling mechanistic[4a-c] and applicatory studies like the implementation of laser-generated catalysts in real fuel cell stacks.[4d]

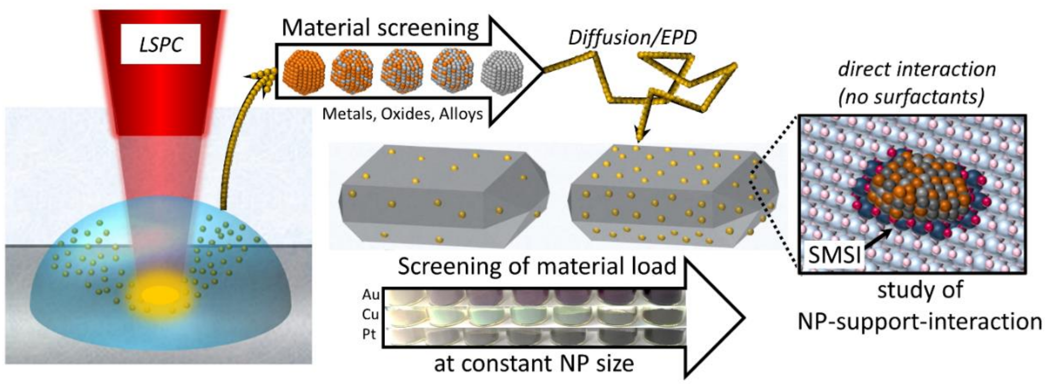

Fig. 1: General strategy of Laser Synthesis and Processing of Colloids (LSPC) in research on heterogeneous catalysis.[2]

The presented talk intends to cover the fundamentals and opportunities of the main synthesis methods such as laser ablation, laser fragmentation, and laser defect engineering, related mechanisms, working hypothesis, and scalability. The previous will be discussed in the frame of several recent catalysis studies conducted with metal, alloy, and spinel-type catalysts conducted in the field of exhaust gas oxidation, electro-, and selective oxidation catalysis. Overall, it will be shown that the set of existing laser-based synthesis methods give rise to catalysts series with an activity similar or higher than commercial reference catalysts and allow to independently address and study materials vectors such as composition, particle size, and material defects in catalysis.[1,2]

References

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