The role of the support in gold-based catalysts for ethanol oxidation

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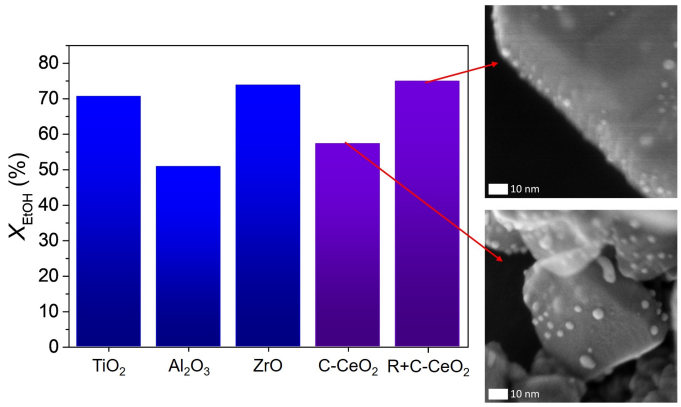
Supported gold nanoparticles are very efficient and selective oxidation catalysts.[1] The gold particle size is a major parameter that affects both conversion and selectivity.[2] The support choice is also very crucial; the best-performing catalysts are supported on reducible oxides, such as titania and ceria, which donate their lattice oxygen around the perimeter of the gold particle for the carbon monoxide oxidation, forming observable oxygen vacancies,[3-4] while on stable oxides, like alumina, the oxygen is directly activated on the gold particle.[5] Hence, the support actively participates in the reaction and its nature and structure can alter the catalytic properties.

In this work we investigate the effect of the support on the gold particle size and the catalytic activity of aqueous ethanol oxidation.[6] The ethanol conversion showed a dependence on the support (Figure; 1%Au/Support). For constant gold particle size (2 nm), over transition metal oxides, titania and zirconia, more than 70% of ethanol was converted at 423 K, while over alumina only 50%. Furthermore, the pre-treatment of the catalyst was decisive. 1%Au/CeO_2 powder underwent two different pre-treatment conditions, calcination at 473 K (C-CeO_2) and reduction at 423 K followed by calcination at 473 K (R+C-CeO_2). Both catalyst resulted in similar particle size (3.5 nm) but exhibited different ethanol conversion, 58 and 75%, respectively. Further characterization and testing of differently treated materials is pending that will allow us to define the catalytic performance descriptors with respect to the support effect.



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