Pt/TiO_2 and Pt/CeO_2 nanostructured materials for fuel cell applications

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Methanol may offer much higher energy densities than either batteries or fuel cells operating on stored H_2, making it an attractive source for advanced portable power. A challenge for fuel processing with respect to the operation level of high temperature PEM fuel cells (200-220°C) is the development of highly active and selective catalysts for methanol reforming to H_2 [1]. Commercially available CuZnAlOx catalysts have been widely used for generating H_2 from methanol. Even though these catalysts are widely used in H_2 plants, several drawbacks limit their application in small stationary or mobile systems. Especially, their pyrophoric behaviour has to be controlled when reduced Cu is abruptly exposed to air after turning off the feed of reactants, since major local temperature spikes can occur due to fast copper oxidation, which may lead to sintering/deactivation of Cu particles. Noble metal-based catalysts have been also proposed as an alternative solution [2]. In this work hydrothermal method was employed for the preparation of titania nanotubes and ceria nanorods as catalyst supports. Platinum nanoparticles were dispersed on the oxide nanostructures (Fig. 1) following three different methods: (a) impregnation, (b) deposition-precipitation and (c) combustion. The catalytic performance of Pt/TiO_2 and Pt/CeO_2 nanostructures has been investigated for the steam reforming of methanol (Table 1) and discussed on the basis of the physicochemical characterization.

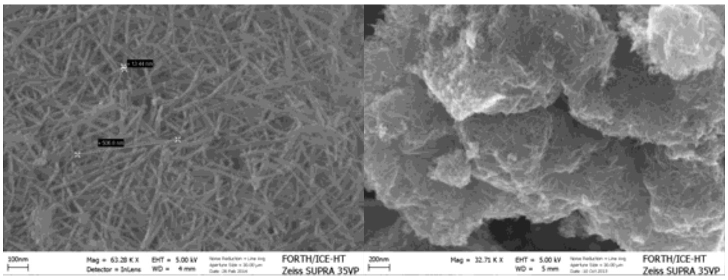

Figure 1: SEM images of Pt/ceria nanorods (left) and Pt/titania nanotubes (right)

Table 1: Catalytic properties of various Pt-based catalysts

	3wt.%Pt/CeO_2 (combustion method)	5wt.%Pt/TNTs (impregnation)	30wt.%Pt/TNTs (impregnation)	30wt.%Pt/C (commercial)
MeOH conversion,%	81	90	99	<5
H_2 selectivity, (%)	85	77	86	67
H_2 yield, %	70	69	85	1.5
R_{H2}, cc/min/g_{Pt}	810	484	99	2

References

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