

CATALYTIC PROPERTIES OF Ni-Cu MIXED OXIDES DEPOSITED ON STAINLESS STEEL MESHES BY PLASMA JET SPUTTERING

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Plasma jet sputtering is a convenient method for preparing catalysts supported on stainless steel meshes. Such catalysts are particularly suitable for processes carried out at high space velocities. One of them is the catalytic total oxidation of volatile organic compounds (VOC), an economically feasible and environmentally friendly method of reducing VOC emissions. Hollow cathode plasma jet sputtering of Ni, Cu and Ni+Cu mixtures in an Ar+O₂ oxidizing atmosphere has been used to create thin oxide coatings on stainless steel meshes. The properties of the supported NiO–CuO catalysts were characterized by EDX, powder XRD, SEM, H₂-TPR, Raman spectroscopy, and XPS. The catalytic activity was investigated in the deep oxidation of ethanol and toluene, which were used as model VOC. The activity of the catalysts in the oxidation of ethanol and toluene (Table 1) was evaluated as specific activity (amount of reactant converted per unit mass of metal oxides per hour) at 200 °C (ethanol) and 350 °C (toluene).

On Ni-Cu oxide catalysts with very low oxide concentration (0.3 wt.%), the toluene oxidation proceeds at temperatures of about 130 °C higher than the ethanol oxidation. The supported catalyst containing only nickel oxide was the most active in ethanol oxidation, while the NiCu11 was most active in toluene oxidation. The activity of supported catalysts were significantly higher (20-50 times) than that of pelletized NiCu11.

Table 1 Properties of Ni-Cu catalysts sputtered over stainless steel meshes and catalytic activity in ethanol and toluene oxidation

Sample	Ni/(Ni+Cu) theor mol mol ⁻¹	Ni/(Ni+Cu) EDX mol mol ⁻¹	MeO _x ^a wt.%	D _{NiO} nm	S _{BET} m ² g _{oxides} ⁻¹	R ₂₀₀ EtOH mmol g _{oxide} ⁻¹ h ⁻¹	R ₃₅₀ Toluene mmol g _{oxide} ⁻¹ h ⁻¹
Cu	0	0.00	0.21	-	9.4	9.8	25.9
NiCu14	0.2	0.14	0.30	9.0	3.3	8.2	31.8
NiCu11	0.5	0.49	0.30	12.1	10.1	6.0	48.5
NiCu41	0.8	0.74	0.29	13.7	10.2	19.1	20.8
Ni	1	0.98	0.17	11.7	17.8	20.6	18.1
NiCu11 _{pel} ^b	0.5	-	100	-	-	0.9	0.6

^a concentration of oxides in catalytic bed, ^b pellets (supported 4x3 mm) of NiCu11 sample

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