Effect of Reaction Parameters on the Durability of Supported CoO_x Catalysts in CO Oxidation

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The durability of CoO_x/TiO_2 catalysts for CO oxidation at 100°C has been studied as a function of reaction parameters. The extent of activity maintenance, as a basis of total conversion, on catalysts with CoO_x amounts smaller and greater than 5 wt%, at which 100% CO conversion had maintained for 5 h, was of particular interest to us because of the need to ascertain their effect on the duration in the oxidation reaction. A 85-% activity was obtained for a 1 wt% CoO_x catalyst, and it decreased rapidly with time and became zero since 7 h. Samples with 8 and 12 wt% CoO_x also gave a short residence in a period of total oxidation, although the both catalysts possessed higher steady-state conversion, depending on the CoO_x contents. It is clear that the durability of this supported catalyst in the oxidation reaction was determined by its CoO_x content. Surprisingly, repeated calcinations and measurements on a single sample altered the duration in the oxidation reaction. Only peaks for Co_3O_4 were observed for all the calcined samples upon XRD measurements, which was very consistent with results acquired by Raman spectroscopy. An average crystallite size of 11 nm was obtained with a sample of 5 wt% CoO_x/TiO_2, but it depended on the amounts of CoO_x loaded.