



金屬-氧化物複合觸媒之製備及其特性研究 Preparation Processes and Characteristics of Metal-Oxide Composite Catalysts

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研究重點

There are two different approaches in this thesis. One approach is to synthesize spinel-type oxides as a precursor preparing Cu or Ni catalysts for steam reforming of methanol (SRM). The other approach focuses on preparation of Au or Pt catalysts from intermetallic compounds or amorphous alloys to perform CO oxidation reaction. These approaches in terms of the Ellingham diagram which is usually used to evaluate the ease of reduction of metal oxides or oxidation of metal.

研究成果

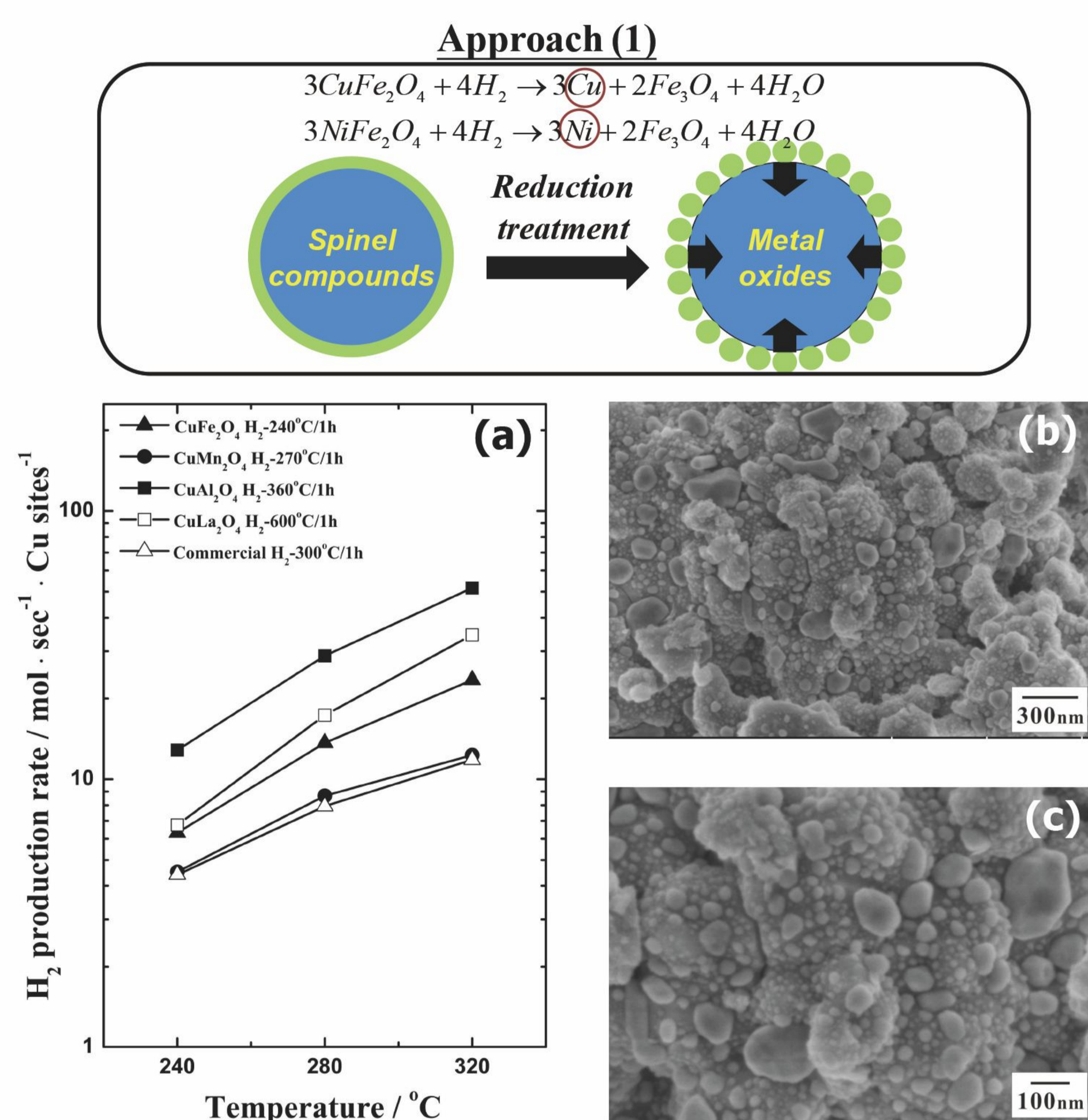


Figure 1 (a) H_2 production rate versus reaction temperature for steam reforming of methanol over the Cu-based spinel compounds, CuO and commercial catalyst after H_2 reduction in terms of $[\text{mol sec}^{-1}\text{Cu sites}^{-1}]$; (b) and (c) SEM micrographs of the CuAl_2O_4 powders after reduction in H_2 atmosphere at 360°C .

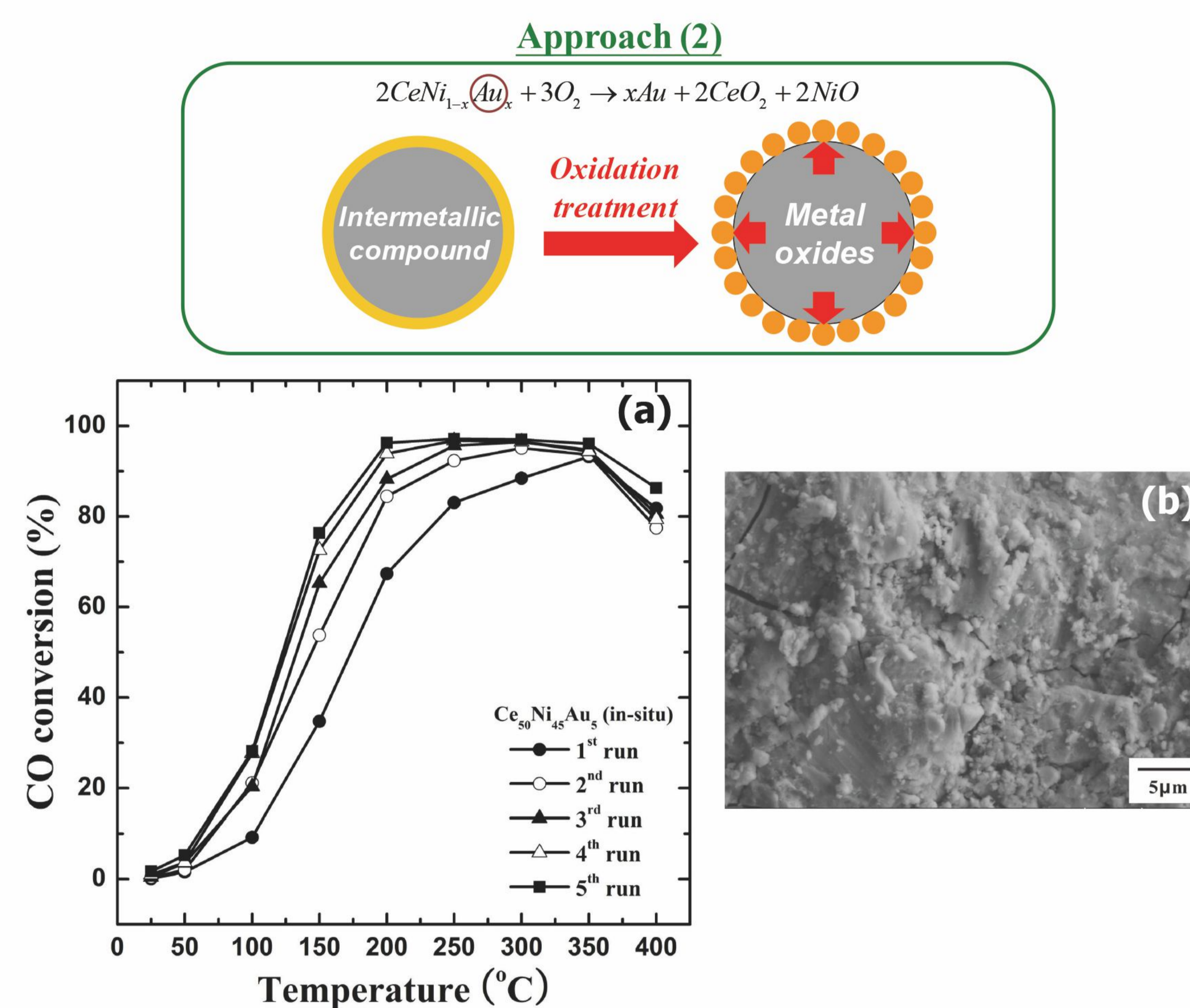


Figure 2 (a) Five runs of CO conversion as function of reaction temperature measurement for CO oxidation over the catalysts prepared by in situ oxidation of (a) $\text{Ce}_{50}\text{Ni}_{45}\text{Au}_5$ intermetallic compound; (b) SEM images of the $\text{Ce}_{50}\text{Ni}_{45}\text{Au}_5$ compounds after 5th cycles CO oxidation reaction.

Approach (1), Fig.1

◆ Reduced Cu-based spinel compounds appear to be a potential synthesis route for preparing a catalyst especially the **CuAl_2O_4 compound**. Even though the catalytic performance of these copper-oxides composites was superior to those of conventional copper catalysts.

◆ After reduction, a huge amount of Cu particles with sizes ranging from **30 nm to 70 nm** were formed on the $\gamma\text{-Al}_2\text{O}_3$ surfaces, the latter revealed a higher catalytic activity solely due to the **larger surface area**.

Approach (2), Fig.2

◆ Catalysts prepared from the **$\text{Ce}_{50}\text{Ni}_{45}\text{Au}_5$ compound**, consisting of metal-oxide complexes including Ni-Au and CeO_2 , showed the best electrolytic activity for CO oxidation. CO conversions of 28.1%, 76.3%, **96.3%** and **97.1%** were achieved at reaction temperatures of 100°C , 150°C , **200°C** and **250°C** respectively.

◆ The high electrolytic activity of the $\text{Ce}_{50}\text{Ni}_{45}\text{Au}_5$ compound at temperatures **below 200°C** was attributed to the fact that a large quantity of fine Ni-Au particles was distributed on the CeO_2 support after thermal treatment.

研究生活及心得

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