Incorporation of an alkaline-alkaline earth metal in an unsupported bimetallic Ni-containing catalyst for the CO_2–SR technology

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Introduction.

In the past decades, global warming resulting from the emission of greenhouse gases, consisting mainly of carbon dioxide and methane, has become one of society's main concerns. In this context, there has been a growing interest in developing technologies that allow the capture and storage of CO_2 in an economical and sustainable way. The application of a heterogeneous bimetallic nickel-barium catalyst as a dual material has been studied for its use in the CO_2 regeneration cyclic process [1]. The present work shows the data corresponding to the substitution of Ba by Ca or Sr and K as a bimetallic catalytic systems to analyse the structural and physicochemical properties and the effect on CO_2 storage capacity.

Experimental/methodology.

The catalysts were synthesised by an ultrasonic assisted coprecipitation of the heterometallic mixed precursors employing an atomic ratio Ni:Me = 1:1 using colloidal silica as surface area promoting agent, and calcined at 800 °C in air for 4 h.

X-ray diffraction (XRD), KBr-FTIR infrared, Raman spectroscopy and nitrogen adsorption-desorption were employed for the characterisation. The CO_2 adsorption capacity was analysed at low temperature and at high reaction temperature.

Results and discussion.

The influence of the incorporation of the metal in combination with nickel has been studied and it has been found that, even at high temperature, it maintains a cubic structure with a surface area higher than 80 $m^2 \cdot g^{-1}$. The crystal size of bivalent or monovalent cation was not affected by the modification of the catalytic formulation. There is a correlation between CO_2 adsorption capacitity and the electronegativity of the second metal incorporated to the nickel structure as shown in Figure 1.

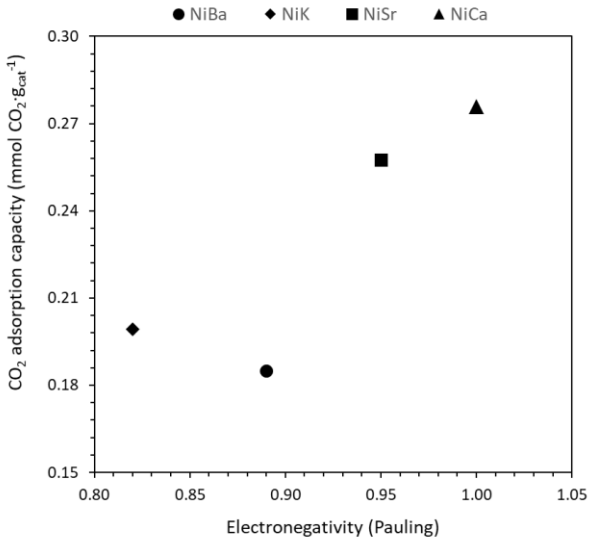

Figure 1. CO_2 adsorption capacity of the catalysts at 25°C versus the electronegativity of the metal incorporated.

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References

[1] S. Molina-Ramírez, et al. *Journal of CO_2 Utilization* **2020**, 40, 2212-9820.