On the effect of promoters over Ni/CeO_2 catalyst for plasma-catalytic CO_2 methanation

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CO_2 hydrogenation to synthetic fuels and value-added chemicals has been lately proposed as a promising technology to stabilize the anthropogenic emissions of this greenhouse gas. CO_2 hydrogenation or Sabatier reaction is one of these processes [1], which has been carried out by different types of metal-supported catalysts. Among all, Ni-based catalysts are the most used due to their high activity, availability and lower cost [2][3][4]. In terms of studied supports, cerium oxide (CeO_2) can be considered as promising because of its favourable properties such as oxygen mobility, which enhances CO_2 activation and hinders carbon deposition [3]. Moreover, it is well known that the use of promoters can improve catalytic activity and stability [5][6]. Plasma catalytic methanation has been proposed, since 2010, as an alternative to the conventional thermal process [3]. However, studies focused on identifying the best plasma catalytic system through plasma or catalyst's design are still on-going. In the present work, non-thermal plasma (NTP)-assisted CO_2 methanation was performed over 15Ni/CeO_2 catalysts promoted with 5wt% of different metals, such as Co, Cu, Fe, La and Y.

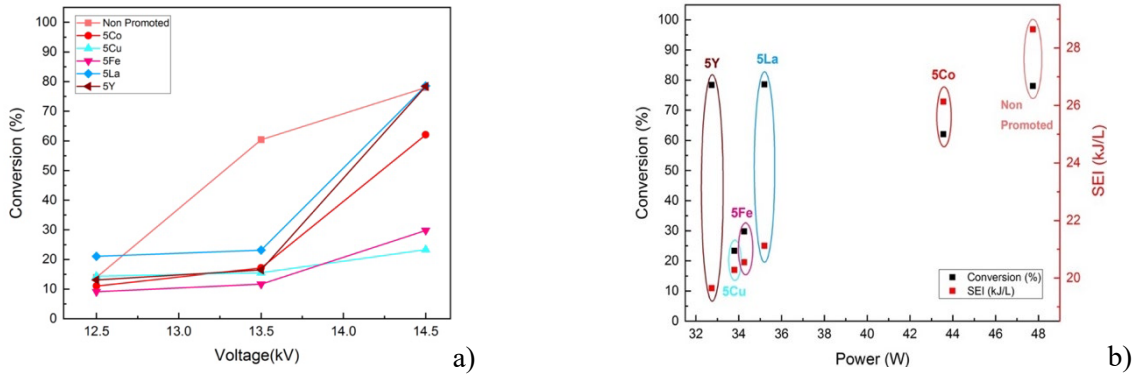

Figure 1. a) CO_2 conversion as a function of input voltage, b) CO_2 conversion as a function of power at 14.5kV input voltage

The promotion effect of Co, La and Y in plasma was proved and could be mostly linked with the basic properties of the metal oxides formed. Also, it can be observed that 5 wt% of Y and La led to the higher CO_2 conversion (78%) and methane selectivity (99%) when compared to the other samples [5]. Also, one could note that, in the presence of Y and La, the consumed power is significantly lower, which leads to synergistic effects. The synergetic effect can be linked with the chemical and physical properties of the proposed catalysts.

References

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