

Sorption enhanced steam methane reforming by Ni– CaO materials supported on mayenite

A. Di Giuliano^{a,b,*}, *J. Girr*^a, *R. Massacesi*^b, *K. Gallucci*^b, *C. Courson*^a

(a) University of Strasbourg, Institut de Chimie et Procédés pour l'Energie, l'Environnement et la Santé, UMR CNRS 7515, ECPM, 25 rue Becquerel, 67087 Strasbourg Cedex 2, France

(b) University of L'Aquila, Department of Industrial Engineering, 18 via G. Gronchi, 67100 L'Aquila, Italy

KEYWORDS:

Sorption enhanced steam methane reforming, Combined sorbent-catalyst material, CO₂ capture

ABSTRACT:

Sorption enhanced steam methane reforming (SESMR), i.e. SMR with in situ CO₂-sorption, can lead to a sustainable and economical exploiting of natural gas for hydrogen production, with high purity and simultaneous sequestration of greenhouse gases. CaO-mayenite CO₂-sorbents, Ni-mayenite SMR catalysts and NiCaO-mayenite combined sorbent catalyst materials (CSCM) for SESMR were synthesized by wet mixing and wet impregnation methods, and characterized by means of XRD, BET/BJH, SEM/EDS, and TPR. For CSCM, an influence of CaO load on textural and Ni reducibility properties was recorded. Materials sorption capacity was measured in multicycles sorption/regeneration TGA tests: it always underwent a stabilization with cycle number increase. Reforming tests in micro-reactor scale were performed on 3 wt% to 10 wt% Ni-mayenite and selected CSCM: all Ni-mayenite always shown good performances, while for CSCM a detrimental role of CaO load on Ni catalytic activity was evidenced.