EXPERIMENTAL INVESTIGATION OF THE EFFECT OF S/V RATIO IN TUBULAR QUARTZ REACTORS ON THERMAL METHANE CRACKING

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Abstract
Experimental tests of non-catalytic thermal methane cracking have been conducted at different temperatures (950, 975 and 1000°C) and with different initial methane flow rates (25, 50 and 100 ml/min) in tubular quartz reactors (i.d.=1-1,5 cm). Tests have been carried out using empty and packed bed reactors with constant heated length (L=20 cm) to investigate the influence of the surface-to-volume ratio (S/V) on methane conversion, carbon products morphology and their relative contributions to the overall carbon balance. A comparison between the two cases has been made to highlight the effects of S/V ratio on surface reactions with respect to the homogeneous ones for the carbon formation. Higher conversions and increased deposited carbon production have been obtained at the highest temperatures tested and in the presence of packed beds (highest S/V). Carbon deposited on the surfaces has resulted to be a dense carbon matrix, morphologically different from carbon nanoparticles produced in the gas phase. Further studies are required in order to accurately investigate the properties of the carbons produced and pave the way to tune desired carbon properties, allowing, in the future, the coupling of sustainable turquoise hydrogen generation with the production of high added value materials.