SYNTHESIS OF SiC BY THE MICROWAVE ASSISTED CARBOTHERMAL REDUCTION OF SUGAR CANE WASTES

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The microwave-assisted carbothermal reduction reaction has been employed successfully to synthesize a large number of ceramic materials such as TiC, Si_3N_4, Al_2O_3/SiC. The system reactions are relatively simple to develop and, as a result, recently this route has been associated to the microwave energy, yielding advantages as energy and time savings, which decreases the overall process cost. Results reported elsewhere confirm the feasibility of microwave-assisted carbothermal reduction reaction (MWCR) to produce the Al_2O_3/SiC composite, starting from a natural aluminosilicate blended with carbon black. Such a work proved that the use of microwave energy decreased the process time from about 4 hours of conventional process to 45 min of MWCR, with a resemblance in the particles morphology from both processes. The present work reports the synthesis of SiC by the MWCR of sugar cane wastes. It is known that the sugar cane wastes are SiO_2 rich as well as other compounds such as K_2O and a low amount of Fe_2O_3. These wastes constitute a by-product of the agricultural and industrial processes of sugar and alcohol production, from sugar cane and have been applied usually as soil recovery agent and as animal food addictives. In order to carry out the reactions, sugar cane wastes were calcined to eliminate organic matter and the inorganic compounds were then blended to carbon black into pellet form, in a stoichiometric proportion of SiO_2 and carbon. These pellets were reacted in a ceramic pipe fluidized bed reactor, under an argon flow to avoid oxidative processes of carbon black, so yielding SiC from reduction of SiO_2 by the carbon. The reactions were carried out into a semi-industrial microwave oven (Cober Inc., USA), able to generate a power level as high as 6 kW. However, a power of 1,5 kW was satisfactory to perform reactions in only 30 min. The reaction temperature was measured using an infrared pyrometer (Raytech, Marathon Series, USA) which allowed resolve a heating rate curve of the reaction. The phases present in the reacted products were evaluated by X ray diffraction (XRD, Siemens D5000) and the particles morphology were examined by scanning electron microscopy (SEM, Philips XL-30 FEG). The system reaction developed here was suitable to produce SiC from MWCR of sugar cane wastes. Heating rate curve demonstrated that the reaction temperature increased fast in the early minutes of the reaction. XRD revealed SiC phase in the product of MWCR during only 30 min of reaction, which demonstrate the feasibility of this process to produce SiC starting from sugar cane wastes. The presence of K_2O and Fe_2O_3 in the raw material yielded SiC with whiskers and spheres morphology, owing to these metallic oxides acted as catalytic sites for the VLS (vapor-liquid-solid) process, which accounts noticeably for the SiC formation.