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Adrian Ramirez, Jose L. Hueso, Reyes Mallada, Jesus Santamaria

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In situ temperature measurements in microwave-heated gas-solid catalytic systems. Detection of hot spots and solid-fluid temperature gradients in the ethylene epoxidation reaction

Adrian Ramirez^a, Jose L. Hueso^{a,b}, Reyes Mallada^{a,b} and Jesus Santamaria^{a,b*}*

^aInstitute of Nanoscience of Aragon and Department of Chemical and Environmental Engineering, University of Zaragoza. C/Mariano Esquillor s/n, 50018 Zaragoza (Spain).

^bNetworking Research Center on Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN), 28029, Madrid (Spain).

KEYWORDS: Microwave Heating, Thermographic Camera, Temperature Measurement, Temperature Gradient, Monoliths, Epoxidation, Ethylene

ABSTRACT. Infrared thermographic techniques have been used for the first time to determine real-time gas and solid temperatures, as well as gas-solid temperature gradients in microwave heated structured reactors. A special reactor vessel has been developed that allows direct observation of the catalyst under microwave heating, and an operating procedure is presented to obtain gas and solid apparent emissivities as a function of temperature. These values are thereafter used to calculate temperatures at any point in the gas and solid phases under reaction. The method has been used to obtain gas and solid temperatures during the ethylene epoxidation reaction carried out on a silver-copper oxide catalyst. The direct heating of the monolith walls produced a stable, large temperature gradient between the solid and the gas phase.

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