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**Isotope labelling: a powerful tool to identify energy wasting processes in DBD plasmas**

Ana Gómez-Ramírez<sup>1</sup>, Antonio M. Montoro-Damas<sup>2</sup>, Agustín R. González-Elipe<sup>2</sup>,  
José Cotrino<sup>3</sup>

<sup>1</sup>University of Seville, Seville, Spain <sup>2</sup>Instituto de Ciencia de Materiales, Sevilla, Spain  
<sup>3</sup>Universidad de Sevilla, Sevilla, Spain

anamaria.gomez@icmse.csic.es

Isotope labelling, a classical method in catalysis to ascertain reactions routes [1, 2], has been scarcely applied in plasma processes [3]. In this work we have used deuterated water as labelling compound to analyse the molecular fragmentation during the plasma wet reforming of methane in a parallel plate packed-bed DBD reactor filled with ferroelectric material [4]. Reaction products were monitored by means of a mass spectrometer. Apart from the expected hydrogen (H<sub>2</sub>) and carbon monoxide (CO), deuteromethanes and molecular hydrogen isotopes (D<sub>2</sub>, HD, CH<sub>3</sub>D, CH<sub>2</sub>D<sub>2</sub>) appear in the reaction products. The existence of isotope labelled molecules (CH<sub>3</sub>D, CH<sub>2</sub>D<sub>2</sub>) is a clear proof of the occurrence of backwards reactions during the wet reforming of methane. These processes imply a waste of energy and, thus, a decrease in the efficiency of the DBD plasma processes, one of the major drawbacks for its industrial implementation. The influence of different parameters, namely, the gas residence time, the current and the addition of oxygen on the H/D distribution and efficiency of the process is analysed. [1] J. Wei and E. Iglesia, *Phys. Chem. Chem. Phys.*, 2004, 6, 3754. [2] L. Y. P. Luk, J. J. Ruiz-Pernía, A. S. Adesina, E. J. Loveridge, I. Tuñón, V. Moliner and R. K. Allemann, *Angew. Chem., Int. Ed.*, 2015, 54, 9016. [3] F. Daou, A. Vincent and J. Amouroux, *Plasma Chem. Plasma Process.*, 2003, 23, 309. [4] A. M. Montoro-Damas, J. J. Brey, M. A. Rodriguez, A. R. González-Elipe and J. Cotrino, *J. Power Sources*, 2015, 296, 268.

**Keywords**

Isotope Labelling  
wet reforming  
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