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Plasma-assisted reduction of NiO/Al_2O_3 catalyst in atmospheric dielectric barrier discharge XIN TU, HELEN J. GALLON, School of Chemistry, The University of Manchester, Oxford Road, Manchester, M13 9PL, UK, MARTYN V. TWIGG, Johnson Matthey Plc., Orchard Road, Royston, SG8 5HE, UK, J. CHRISTOPHER WHITEHEAD, School of Chemistry, The University of Manchester, Oxford Road, Manchester, M13 9PL, UK, PLASMA CHEMISTRY GROUP COLLABORATION, JOHNSON MATTHEY PLC. COLLABORATION — The activation of a NiO/Al_2O_3 catalyst has been carried out using a CH_4 plasma in an atmospheric dielectric barrier discharge reactor. The catalyst was reduced from NiO to the active Ni form, which showed high selectivity for the conversion of CH_4 into H_2 and solid carbon. Characterisation of the reduced catalyst by SEM analysis revealed the presence of significant amounts of carbon nanofibres on the catalyst surface. The machanism for the NiO/Al_2O_3 catalyst reduction in non-thermal plasma was proposed. In addition, the reduced Ni/Al_2O_3 catalyst has been tested for dry reforming of CH_4. The presence of the catalyst in the discharge greatly decreased the breakdown voltage due to the distortion effect of local electric field around pellets. The plasma reduced catalyst significantly improved the H_2 selectivity (45.2 %), in comparison to the reaction with no catalyst, resulting in an increase in the H_2/CO ratio from 0.84 to 2.53.

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