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Methane conversion into oxygenates

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The aim of this work is to find a new heterogeneous catalyst to convert the abundant methane gas in a direct route (one step) reaction into useful and transportable oxygenates using hydrogen peroxide as clean and efficient oxidation agent at mild conditions without using organic solvent. For this purpose, several catalysts have been selected and tested to oxidize methane to its oxygenates using hydrogen peroxide as oxidation agent. These catalysts were Al_2O_3, TiO_2, TS-1, H-ZSM-5, Al-MCM-41, Ti-SBA-15 and Ti-MCM-41. Surprisingly, among all these catalysts, H-ZSM-5 (25) zeolite catalyst showed high activity and very good selectivity. Methane conversion over H-ZSM-5 (25) catalyst was much higher than over all other catalysts. About 85 mole% formic acid selectivity (based on methane conversion) and about 78 mole% (based on H_2O_2 conversion) at 21 mole% methane conversion were achieved over the self-synthesized HZSM-5 catalyst having SiO_2/Al_2O_3=15 molar ratio. The by-product is only CO_2. From catalyst performance testing and characterization results, it was concluded and proved that the Brönsted acid sites are the important and needed for this reaction.

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Thermal degradation kinetics of powder-free laboratory examination gloves to fuel and chemicals

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The aim of this investigation is to develop a multi-steps thermolysis to crack safety glove (LSG), without catalyst, to fuel and useful chemicals. The advantages of this work are two: (1) clean up the environmental pollution caused by ever increasing amount of plastic materials and (2) conversion of wastes to fuel and useful chemicals. Latex based products similar to Polyvinylchloride (PVC) contain a high amount of chlorine (40% by mass). A multi-stage degradation may result on separation of chlorinated compound from main body of material. Later on, degradation may result on chlorine free chemicals that could be used as fuel or other industrial applications. For this, a three- stage thermogravimetric analyses were performed on a small samples of LEG. The sample was heated fast from room temperature to 310°C, where the sample was held there for 90 min. Then, it was heated fast to 410°C, where it was hold for 30 min. The residual was heated fast to 850°C, where white ashes were remained. The obtained data for each step was analyzed based on kinetics models. The rate of reaction, the order of reaction and the activation energy for each step was determined and related to the chemical structure of the reactants.

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