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H-D exchange between CD_4 and solid acids: $AlCl_3$/sulfonic acid resin, promoted and unpromoted sulfated zirconia, and zeolite HZSM-5

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Abstract:
The H-D exchange reaction between CD_4 and each of a family of solid acids (the zeolite HZSM-5, sulfated zirconia, iron- and manganese-promoted sulfated zirconia, and $AlCl_3$/sulfonic acid resin) was investigated with a batch recirculation flow reactor. the data determine initial rates of the exchange reaction giving CD_3H at temperatures ranging from 440 K for $AlCl_3$/sulfonic acid resin to 688 and 703 K for the zeolite and promoted sulfated zirconia, respectively. Extrapolated results show that the reaction is three orders of magnitude faster with the $AlCl_3$/sulfonated resin tan analogue of the very strongly acidic combination of $AlCl_3$ and H_2SO_4) than with HZSM-5 or promoted sulfated zirconia and two orders of magnitude faster with the latter than with sulfated zirconia.