Oligmoerization of light olefins over ZSM-5 and beta zeolite catalysts by modifying textural properties

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The oligomerization of ethene and 1-hexene was performed under 35 bar and 200 °C over NiH- and H-forms of ZSM-5 and beta zeolite catalysts which had similar Si/Al and Ni content, but different textural properties. Among the H-zeolites, H-ZSM-5 and H-beta composed of nanometer scale (ca. 10 nm) sheet-like crystals, as well as intercrystalline mesoporosity (ca. 5 nm), were found to be much more efficient for the oligomerization of 1-hexene to liquid fuel range products higher than C10. In the oligomerization of ethene, identically prepared ZSM-5 and beta but with further exchange with Ni ion, also showed higher activity with remarkable C10+ product selectivity (>80%) after a single stage oligomerization, as compared to the corresponding cation form of ZSM-5 and beta zeolites without nanocrystalline and mesoporous morphology (conversion<50% and C10+ selectivity<30%). These results demonstrate that both small crystal size and the mesoporosity of the zeolite catalyst are critical factors for improving the diffusion limitation during the oligomerization of light olefins. This improvement was accompanied by a shift in major oligomeric product selectivity toward C10+ hydrocarbons.