Aerosol synthesis of porous Particles for structured layers as catalyst support for Fischer–Tropsch reaction

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Using materials with well-defined porous structures as catalyst support provide new possibilities for tuning the catalytic properties (particularly the selectivity) for the Fischer-Tropsch (FTS) synthesis [Zhang 2010]. Saib et al found that the pore size of the support has a strong effect on the activity and selectivity of the catalyst [Saib 2002].Therefore, for FTS, it is desirable to develop a new method to prepare a catalyst support with controllable pore size distribution.

In this paper, we present a novel aerosol approach towards the preparation of well-defined trimodal porous layered structure as catalyst support for Fischer–Tropsch synthesis, which consists of two layers of porous SiO_2-building blocks and one layer of spherical glass particles (Fig. 1).

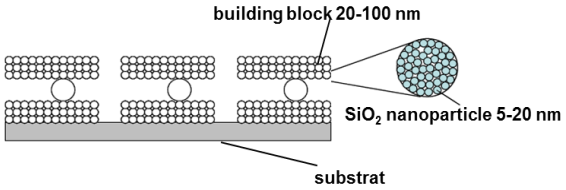

Fig. 1 Schematic representation of porous structured layers of building blocks

Firstly, porous silica particles were synthesized by spray drying process. The synthesis setup consists of an aerosol generator, a tube furnace and a filtration station. Templates (Polyvinylpyrrolidone, PVP) containing silica aerosols were generated by an atomizer operated with compressed air. The droplets were tempered in a tube furnace at 400-500°C. The dry particles were collected on a filter in a filtration station which was heated to 100°C during the synthesis.

The collected particles were heat treated at 500°C for 6 h to remove PVP. After calcination the products were characterized by SEM, TEM and nitrogen sorption.

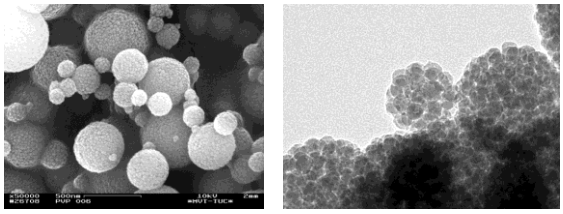

Fig. 2 SEM (left) and TEM (right) micrographs of porous particles

Through surface filtration or impaction of the aerosol, two layers of building blocks were deposited and reinforced by pressure and thermal treatment. The two single layers were then bound by partially melted glass particles.

In this contribution the aerosol synthesis of the different building blocks will be outlined together with the results of the porosity characterization. It will be shown that pore size and the porosity can be tailored by controlling the amount of polymer template and the type of colloids. In addition, the thermal stability of the porous particles will be presented.

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