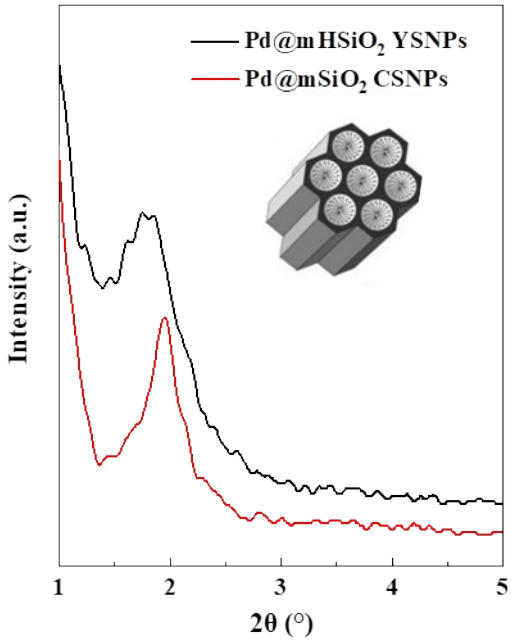

Fig. S1.small-angle XRD patterns of the Pd@mSiO$_2$ CSNPs and Pd@mHSiO$_2$ YSNPs.

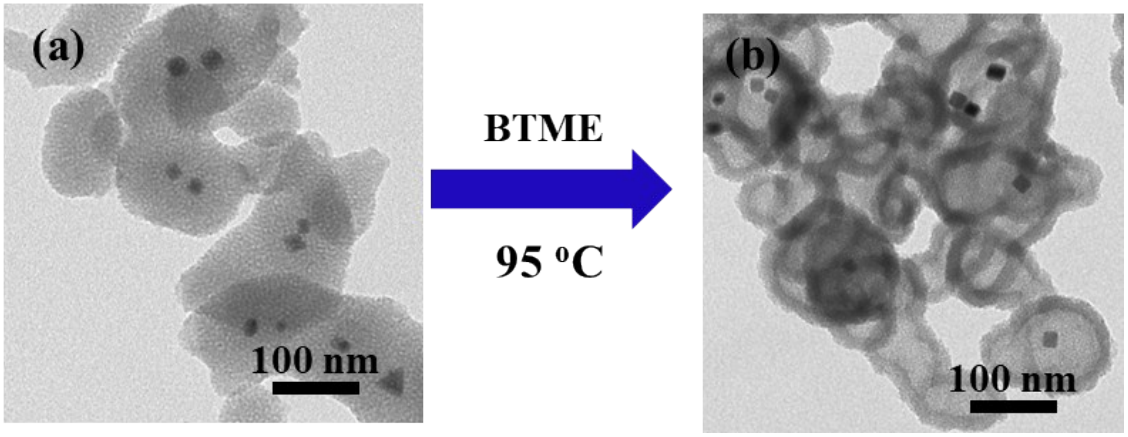

Fig. S2. The sample prepared by increasing the TEOS volume to 0.48 mL: (a) Pd@SiO$_2$ CSNPs and (b) Pd@HSiO$_2$ YSNPs.

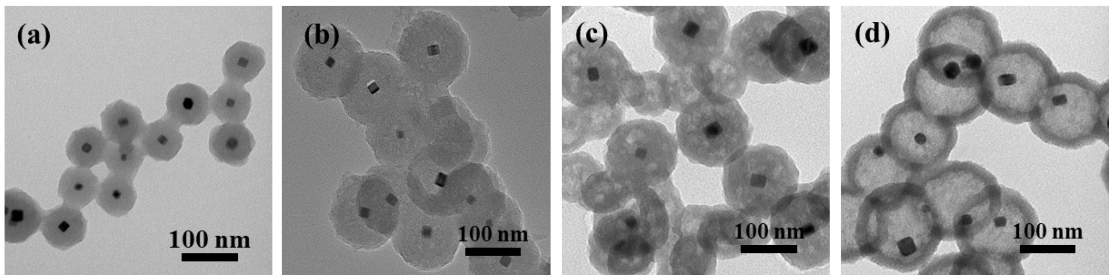

Fig. S3. TEM image of different samples:(a) Pd@SiO_2 CSNPs, (b) Pd@$HSiO_2$ YSNPs prepared by add BTME at 30 °C, (c) Pd@$HSiO_2$ YSNPs prepared by add BTME at 60 °C, Pd@$HSiO_2$ YSNPs prepared by add BTME at 95 °C.

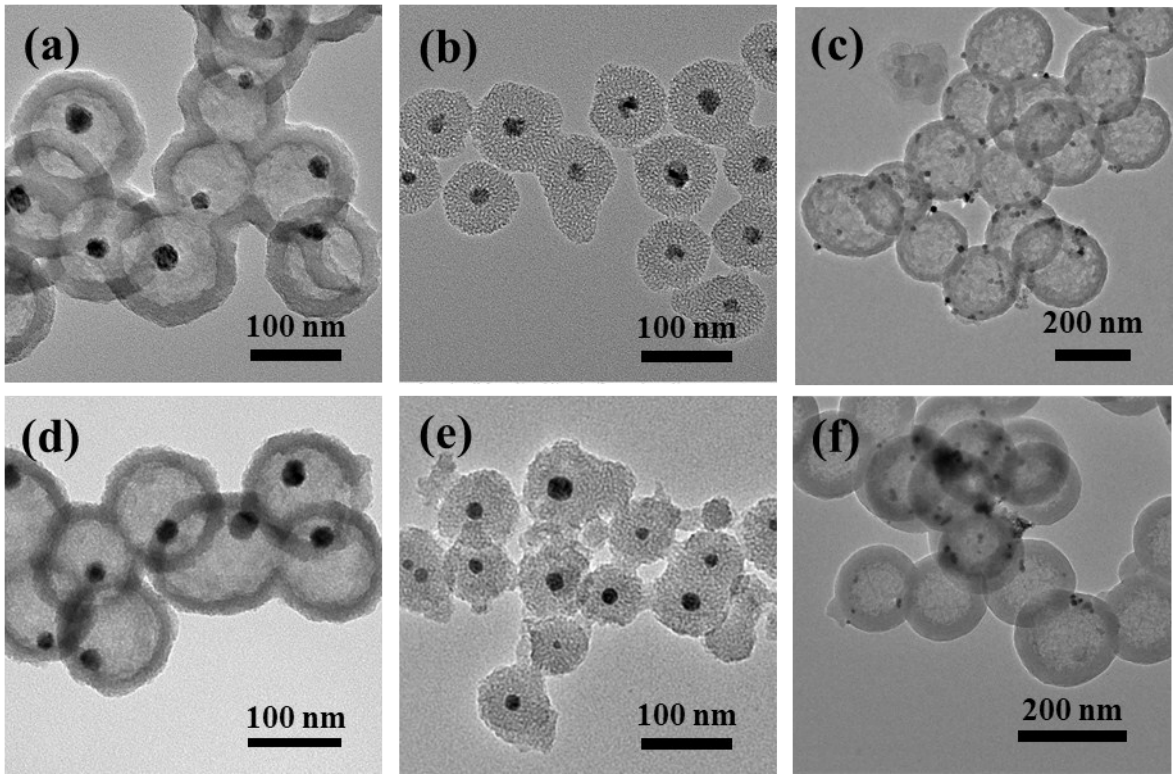

Fig. S4. TEM images of the catalyst after five cycles. (a, d) Pd@m$HSiO_2$ YSNPs, (b, e) Pd@mSiO_2 CSNPs, (c, f) Pd/mSiO_2 NSs.

Table.S1 mesoporous silica shell parameters and metal contents of the different core-shell catalysis synthesized.

Sample	ICP-AES (wt%)		N_2-physisorption		
	fresh	After five cycles	S_{BET} (m^2g^{-1})	V_{void} (cm^3g^{-1})	D_{peak} (nm)
Pd@mSiO_2 YSNPs	2.38	2.31	707.35	0.91	2.0
Pd@mSiO_2 CSNPs	7.50	6.98	957.82	1.25	2.2
Pd/m$HSiO_2$ NSs	3.35	1.05	623.36	1.21	2.7