Controlled synthesis of PVP-based carbon supported Ru nanoparticles: synthesis approaches, characterization, capping agent removal and catalytic behavior

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Supporting information

![Graph a](image1.png)

![Graph b](image2.png)
Fig. S1. XP spectra of O1s region of pristine Sibunit (a), CNF-Pl (b) and TiC-CDC (c) carbon materials.
Fig. S2. Representative TEM images (right) and histograms of particles size distribution (left) of PVP-based Ru/Sibunit catalysts: a – Ru/C-4 initial; b - Ru/C-4, H₂O, 4 h; c - Ru/C-4, air, 180°C/H₂, 250°C; d - Ru/C-5 initial.
**Fig. S3.** Representative TEM images (right) and histogram of particles size distribution (left) of PVP-based Ru/CNF catalysts: a – Ru/CNF-1 initial; b - Ru/CNF-1, H$_2$O, 4 h; c - Ru/CNF-1, air, 180°C/H$_2$, 250°C; d - Ru/CNF-4 initial.
Ru/IC-CDC-1 initial
size - 231
mean - 2.4 nm
SD - 0.4
$d_1$ - 2.5 nm
$d_2$ - 2.6 nm

Ru/IC-CDC-1 after 180°C, 250°C
size - 277
mean - 2.2 nm
SD - 0.3
$d_1$ - 2.3 nm
$d_2$ - 2.3 nm

Ru/IC-CDC-4 initial
Count 281
Mean 2.67
Ds 2.84
Dm 2.91
SD 0.48
Fig. S4. Representative TEM images (right) and histogram of particles size distribution (left) of PVP-based Ru/TiC-CDC catalysts: a – Ru/TiC-CDC-1 initial; b - Ru/TiC-CDC-1, H₂O, 4 h; c - Ru/TiC-CDC-1, air, 180°C/H₂, 250°C; d – Ru/TiC-CDC-4 initial; e - Ru/TiC-CDC-4, H₂O, 4 h; f - Ru/TiC-CDC-4, air, 180°C/H₂, 250°C.
**Fig. S5.** XP spectra of Ru3d$_{5/2}$ region of Ru/C-1 and Ru/C-5 series: 1 – Ru/C-1; 2 - Ru/C-5; 3 – Ru/C-5, H$_2$O, 4h; 4 - Ru/C-5, H$_2$O/H$_2$, 250°C; 5 - Ru/C-5, air/H$_2$, 250°C.