

ESI for

Catalytic epoxidation of β -ionone epoxidation with molecular oxygen on selenium-doped silica

Peizi Li^a, Kuanhong Cao^a, Xiaobi Jing^a, Yonghong Liu^{a,*}, and Lei Yu^{a,*}

^aSchool of Chemistry and Chemical Engineering, Yangzhou University, Yangzhou,

Jiangsu 225002, China

Fax: +86 514 87975244; Tel: +86 136 65295901; Emails: yhliu@yzu.edu.cn (Y. Liu);
yulei@yzu.edu.cn (L. Yu)

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FT-IR spectra of the materials

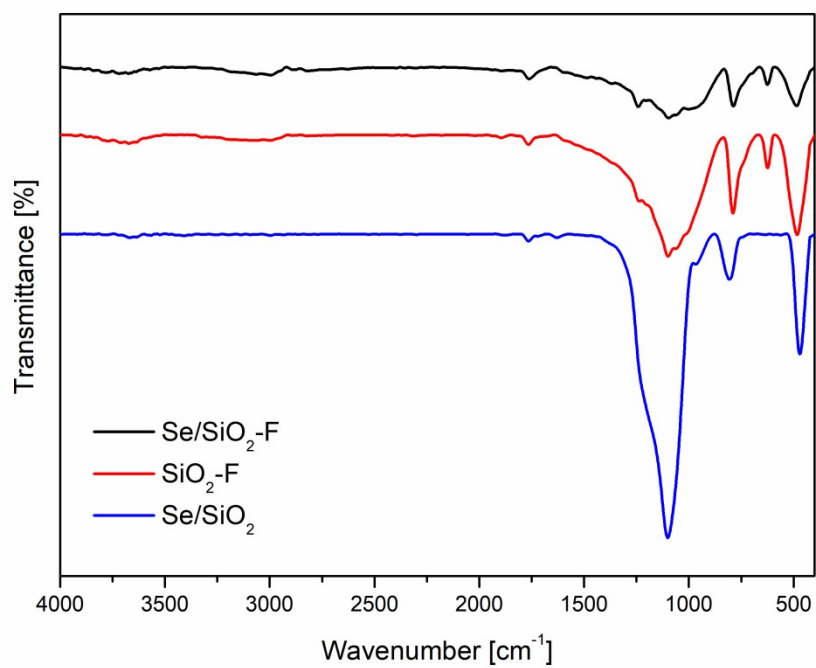


Fig. S1. FT-IR spectra of the materials.

XRD patterns of the materials

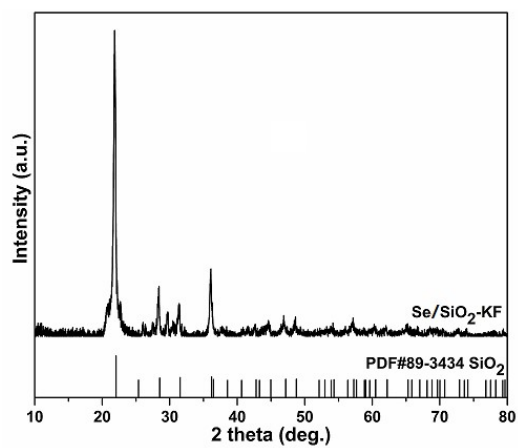


Fig. S2. XRD pattern of Se/SiO₂-KF.

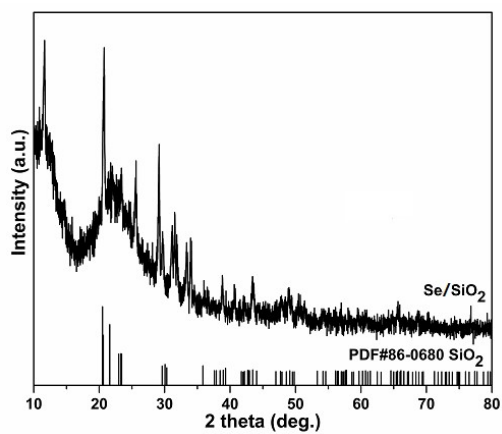


Fig. S3. XRD pattern of Se/SiO₂.

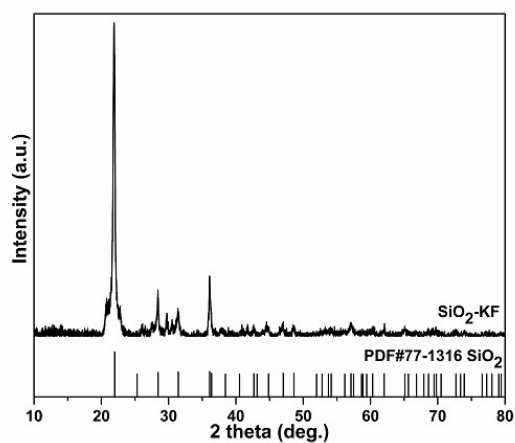


Fig. S4. XRD pattern of SiO₂-KF.

XPS details

ESCALAB 250Xi of Thermo Fisher Scientific with mono Al K α (1486.6 eV) was employed. When the neutralization gun was turned on in the whole process, the test beam spot size was 500 μm under standard mode (CAE). Full spectrum passing energy was 150 eV, with step size at 1.0 eV; Narrow spectrum passing energy was 30 eV, with step size at 0.05 eV. The sample was pre-vacuumized to 2.0×10^{-8} mbar in the injection chamber and transferred to the analysis chamber of 9.0×10^{-10} mbar step by step. In the actual test, the vacuum was 3.0×10^{-7} mbar because the neutralization gun was turned on.

Chemical state	Binding energy Si 2p/eV
Organic Si	102 (References:1)
SiO ₂	103.5 (References:1)

Chemical state	Binding energy Se 3d/eV
Se	55.2 (Ref. 1)
Se ⁴⁺	59.07 (Ref. 2)

References:

1. <https://srdata.nist.gov/xps/selEnergyType.aspx>
2. S. Zhu, J. Hu, S. Liu. Carbohydr. Polym. 246 (2020) 116545.

XPS spectrum of Se/SiO₂-F on F

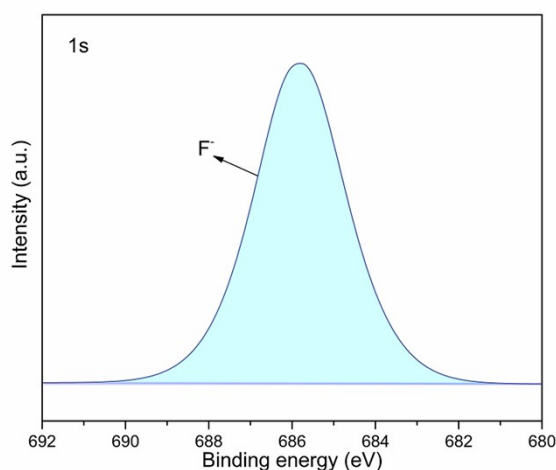


Fig. S5. XPS spectrum of Se/SiO₂-F on F.

EDX spectrum of Se/SiO₂-F

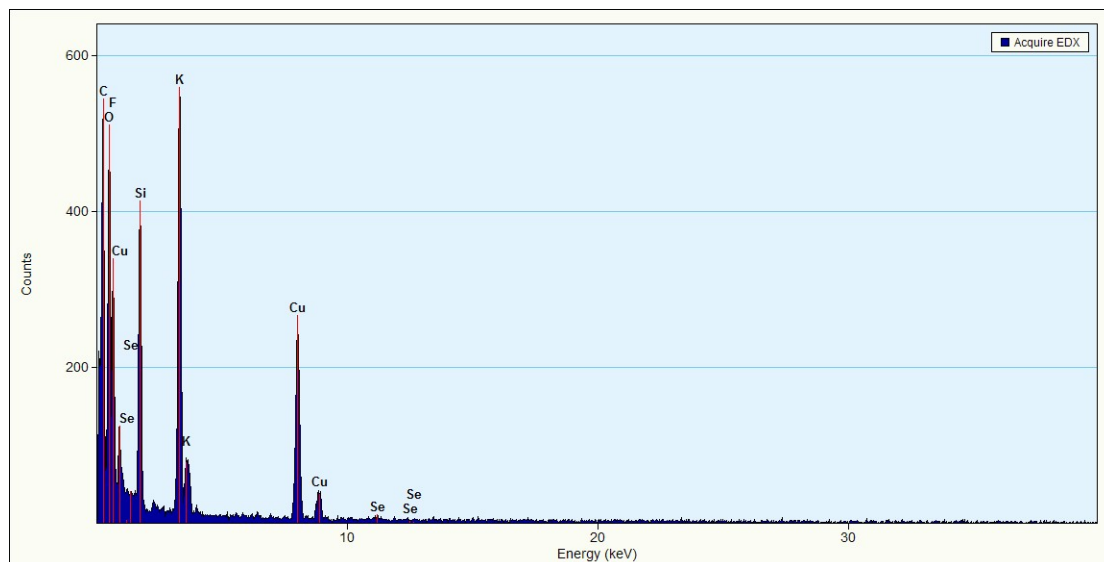


Fig. S6. EDX spectrum of Se/SiO₂-F.

¹H NMR data and spectrum of β -ionone epoxide

¹H NMR (400 MHz, CDCl₃) δ 7.00 (d, J = 15.7 Hz, 1H), 6.27 (d, J = 15.6 Hz, 1H), 2.26 (s, 3H), 1.88 (dq, J = 9.9, 7.9 Hz, 1H), 1.74 (dt, J = 14.7, 5.3 Hz, 1H), 1.48 – 1.37 (m, 3H), 1.13 (s, 6H), 1.06 (ddd, J = 10.9, 5.3, 2.2 Hz, 1H), 0.92 (s, 3H). Known product [Catal. Sci. Technol. 8 (2018) 5017–5023].

