catalysts

MDPI

Supplementary Materials

The Development of High-Performance Platinum-Ruthenium Catalysts for the Methanol Oxidation Reaction: Gram-Scale Synthesis, Composition, Morphology, and Functional Characteristics

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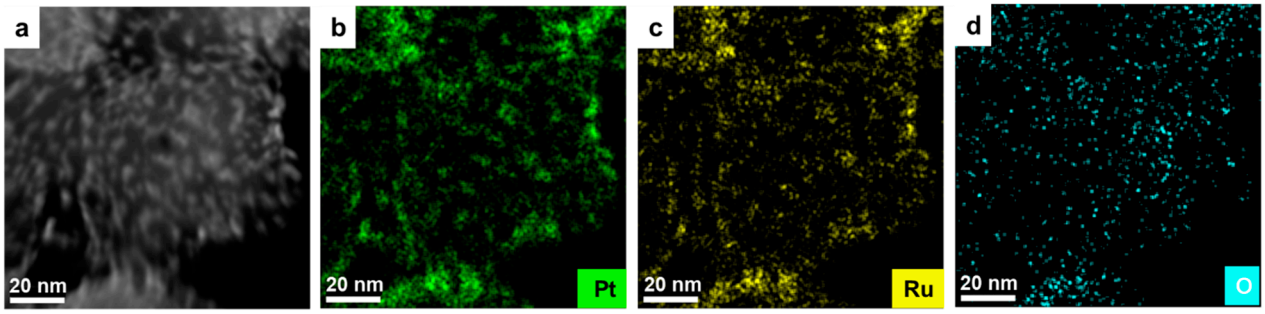

Figure S1. The elemental mapping of the surface fragment for the EG sample: the STEM micrograph of the surface (**a**), the distribution maps of platinum (**b**), oxygen (**c**), and ruthenium (**d**).

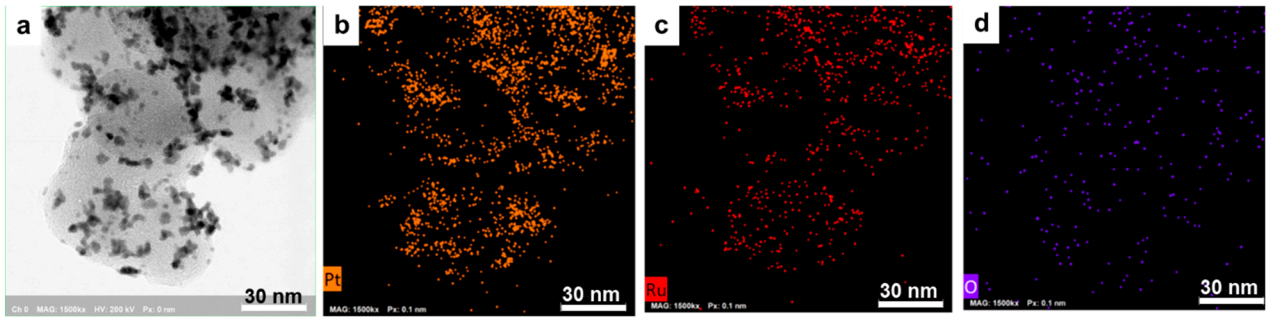

Figure S2. The elemental mapping of the surface fragment for the Et-3 sample: the STEM micrograph of the surface (**a**), the distribution maps of platinum (**b**), oxygen (**c**), and ruthenium (**d**).

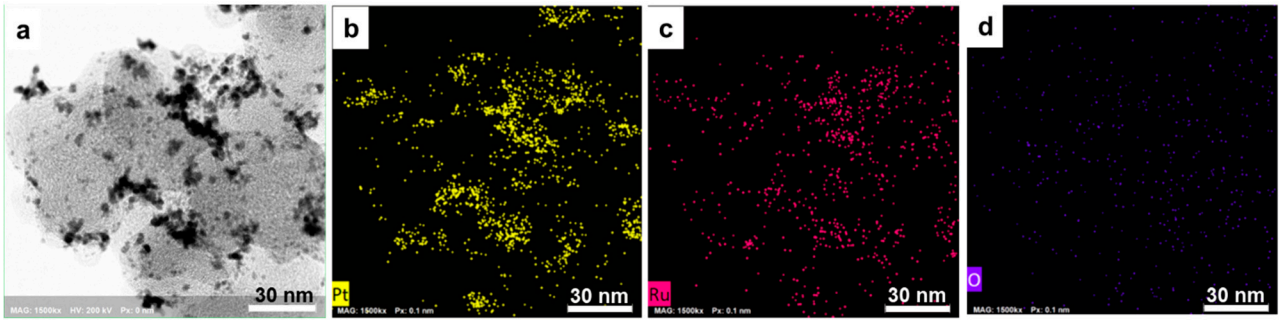

Figure S3. The elemental mapping of the surface fragment for the Et-10 sample: the STEM micrograph of the surface (**a**), the distribution maps of platinum (**b**), oxygen (**c**), and ruthenium (**d**).

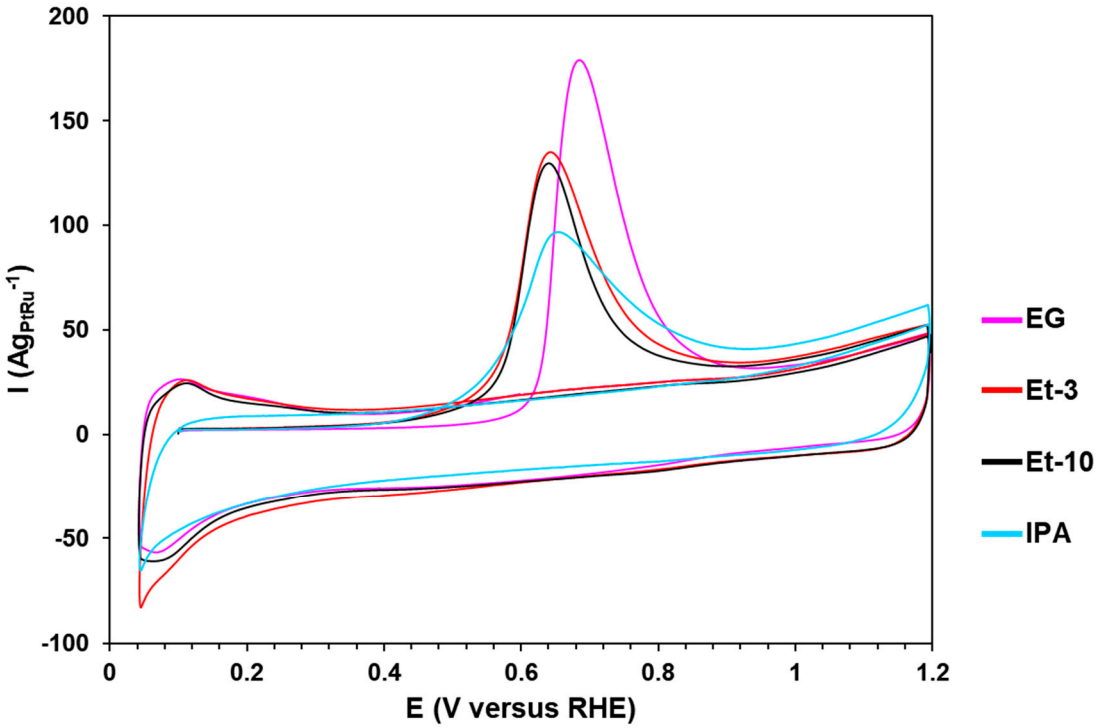

Figure S4. CO-stripping, the potential sweep rate is 40 mVs^{-1}, the atmosphere of Ar.

Table S1. Composition, phase, and structure of the platinum-ruthenium materials.

Sample	Metal-Loading, %	Pt-Loading, %	Pt:Ru Atomic Ratio (TXRF)	D_{AV}, nm (XRD)
EG-60	56.2	37.0	PtRu	1.7
EG-40	39.6	27.0	$PtRu_{0.9}$	1.5
EG-30	28.6	18.9	PtRu	1.4
PtRu-com	60	40	PtRu	3.1

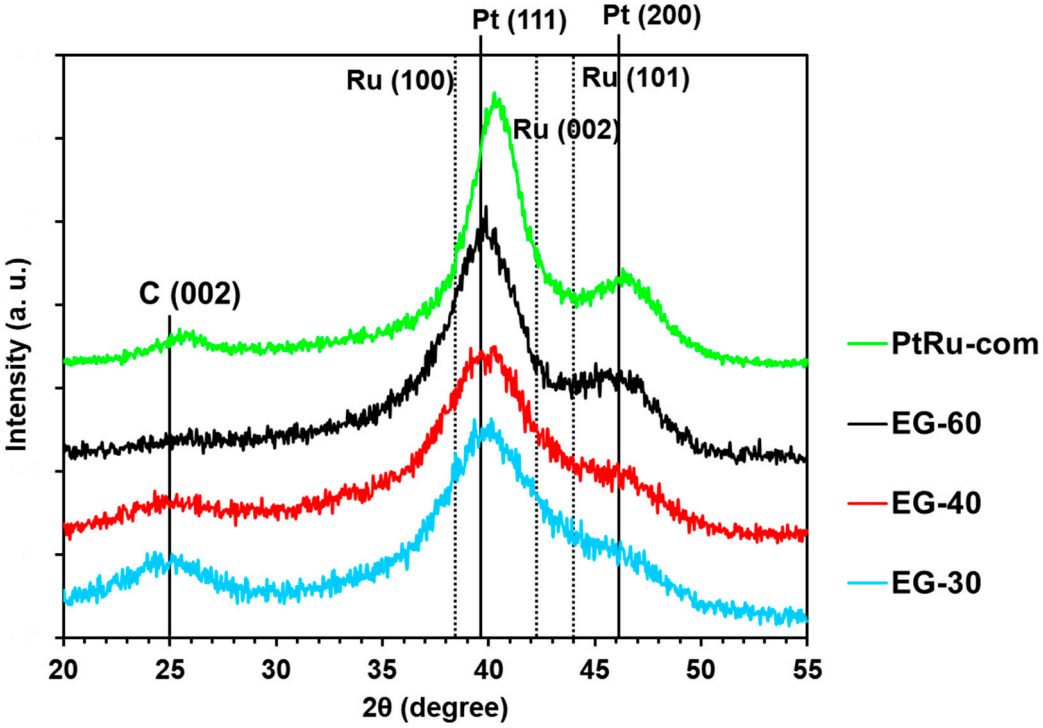

Figure S5. X-ray diffraction patterns of the PtRu/C materials obtained by the ethylene glycol, ethanol, and isopropanol synthesis methods.

Table S2. Electrochemical characteristics of the platinum-ruthenium materials.

Sample	E_{ONSET}, V (CO)	E_{PEAK}, V (CO)	ESA_{CO}, $m^2g_{PtRu}^{-1}$	E_{onset}, V (MOR)	I_{max}, Ag_{PtRu}^{-1}	Q_{CH3OH}, $mQg_{PtRu}^{-1} * 10^{-5}$	$I_{initial}$, Ag_{PtRu}^{-1}	I_{final}, Ag_{PtRu}^{-1}
EG-60	0.40	0.61	82	0.39	668	80.0	85	39
EG-40	0.42	0.64	87	0.41	630	68.9	73	36
EG-30	0.47	0.67	106	0.42	531	60.7	74	39
PtRu-com	0.41	0.63	64	0.39	696	88.8	88	17

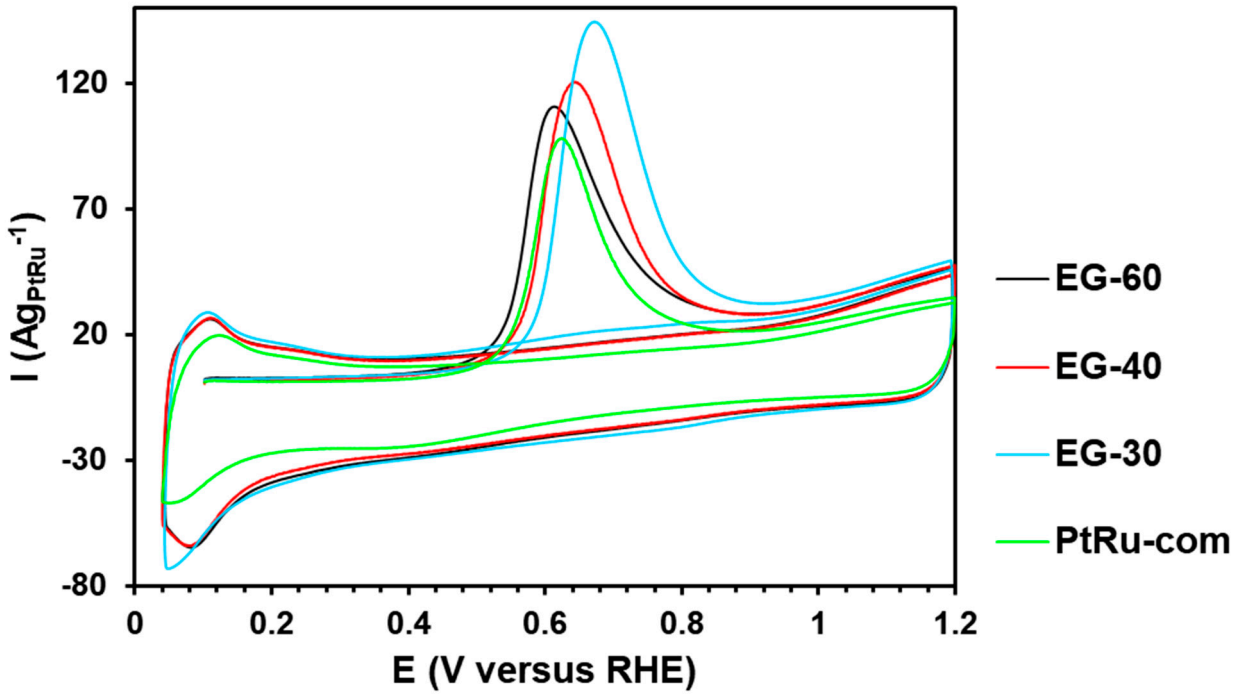

Figure S6. CO-stripping, the potential sweep rate is 40 mVs^{-1}, the atmosphere of Ar.