Electronic Supplementary Material (ESI) for RSC Advances.


# Electrochemical Investigation and Amperometry Determination Iodate Based on Ionic Liquid/Polyoxotungstate/P-Doped Electrochemically Reduced Graphene Oxide Multi-component Nanocomposite Modified Glassy Carbon Electrode

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## Supporting information

The ATR-FTIR spectra of synthesized compounds are shown in Figure S1. The information is summarized in Table S1.

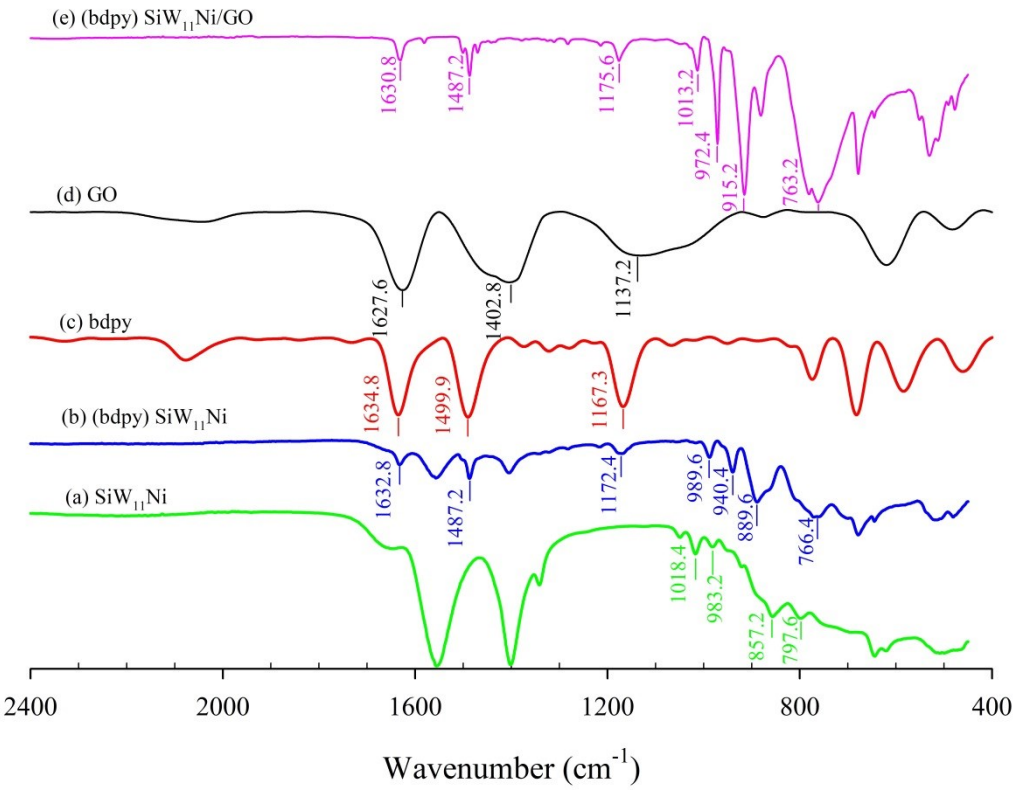


**Figure S1** ATR-FTIR spectra of $SiW_{11}Ni$ (a), (bdpy)$SiW_{11}Ni$ (b), bdpy (c), GO (d), and (bdpy)$SiW_{11}Ni$/GO (e)

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**Table S1** FT-IR data ($\bar{\upsilon}$/cm$^{-1}$) of $SiW_{11}Ni$, (bdpy)$SiW_{11}Ni$, bdpy, GO, and (bdpy)$SiW_{11}Ni$/GO

| **Compound** | **$\bar{\upsilon}$(C=C)** | **$\bar{\upsilon}$(C-O)** | **$\bar{\upsilon}$(C-N)** | **$\bar{\upsilon}$(Si-$O_a$)** | **$\bar{\upsilon}$(W-$O_d$)** | **$\bar{\upsilon}$(W-$O_b$-W)** | **$\bar{\upsilon}$(W-$O_c$-W)** |
|---|---|---|---|---|---|---|---|
| $SiW_{11}Ni$ | - | - | - | 1018.4 | 983.2 | 857.2 | 797.6 |
| bdpy | 1634.8, 1499.9 | - | 1167.3 | - | - | - | - |
| (bdpy)$SiW_{11}Ni$ | 1632.8, 1487.2 | - | 1172.4 | 989.6 | 940.4 | 889.6 | 766.4 |
| GO | 1627.6, 1402.8 | 1137.2 | - | - | - | - | - |
| (bdpy)$SiW_{11}Ni$/GO | 1630.8, 1487.2 | 1175.6 | 1175.6 | 1013.2 | 972.4 | 915.2 | 763.2 |

$O_a$ Central oxygen
$O_b$, $O_c$ Bridging oxygen
$O_d$ Terminal oxygens

The UV-vis spectrum of $SiW_{11}Ni$ (Figure S2, curve a) shows bands associated with terminal W-$O_d$ ($O_d$, terminal oxygen) links for $O_d \rightarrow W$ charge transfer, and W-$O_{b/c}$-W ($O_b$, $O_c$, bridging oxygen) characteristic tri-centric links that attributed to $O_b/O_c \rightarrow W$ charge transfer transitions. According to previous literature data, $O_d \rightarrow W$ charge transfer transition occurs at 185–195 nm with a high molar absorption coefficient [77-79]. Therefore, only the peak tail corresponding to W-$O_d$ appears in the spectrum (absorptions at about 200 nm), but we noticed that the peak was very strong, which corresponds to higher binding energies. The second peak at 250 nm is characteristic for W-$O_{b/c}$-W bounds. Moreover, a broad and weak peak in the visible region at about 467 nm appeared in the spectrum (inset of Figure S2). This pattern is typical for tetrahedral Ni (II) complexes and may be assigned to $^3T_1(F) \rightarrow {}^3T_1(P)$ transition.

UV-vis spectrum of bdpy (Figure S2, curve b) shows an absorption peak and an absorption shoulder at 258 and 265nm, respectively. Since pyridine is existent in the structure of bdpy ionic liquid and on the other hand, pyridine is a heterocyclic compound, so these peaks show the electronic transitions resulting from the $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions. For (bdpy)$SiW_{11}Ni$ hybrid compound, in addition to these absorption bands, an absorption band at 217 nm also appeared that attributed to $O_b/O_c \rightarrow W$ transitions (Figure S2, curve c). However, the red-shift of the $O_b/O_c \rightarrow W$ transitions correlates with the interactions between the polyoxoanion and organic cation.

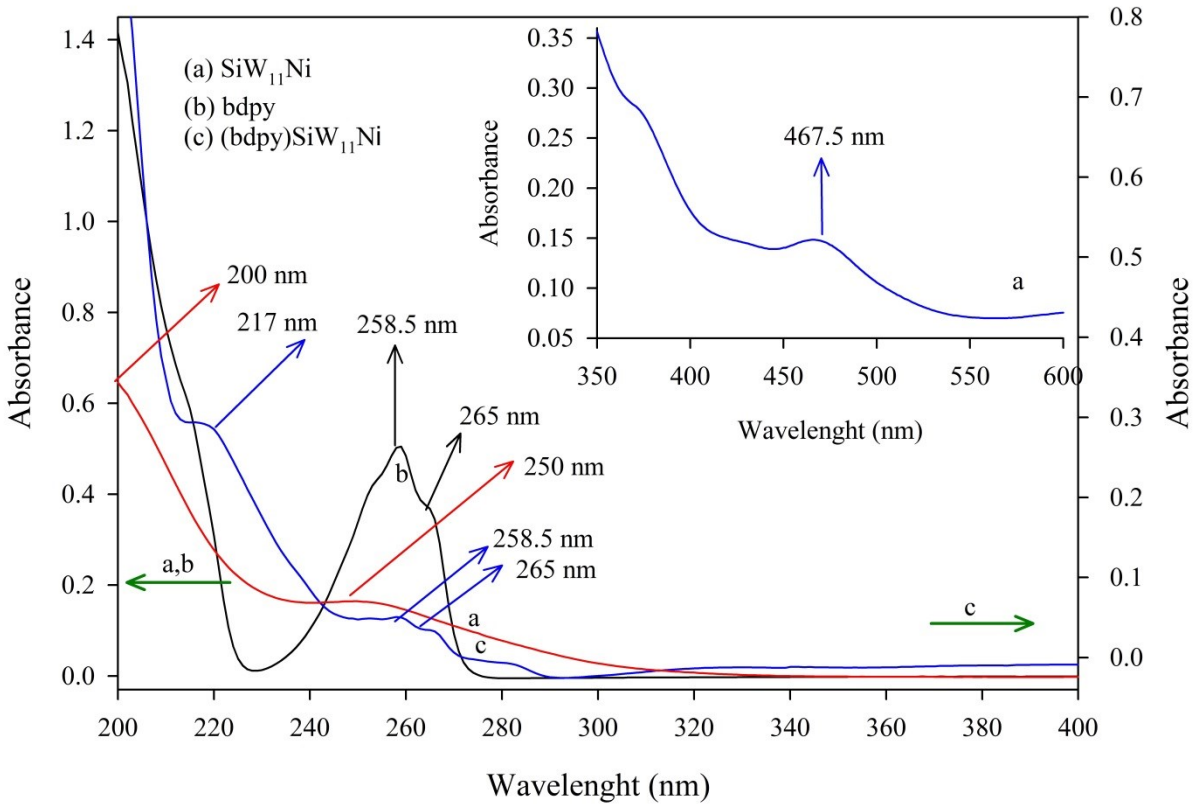


**Figure S2** UV-Vis spectra of $SiW_{11}Ni$ (a), bdpy (b) in deionized water, and $(bdpy)SiW_{11}Ni$ (c) in acetonitrile. The inset shows the UV-Vis spectrum of $SiW_{11}Ni$ in deionized water at 350-600 nm.

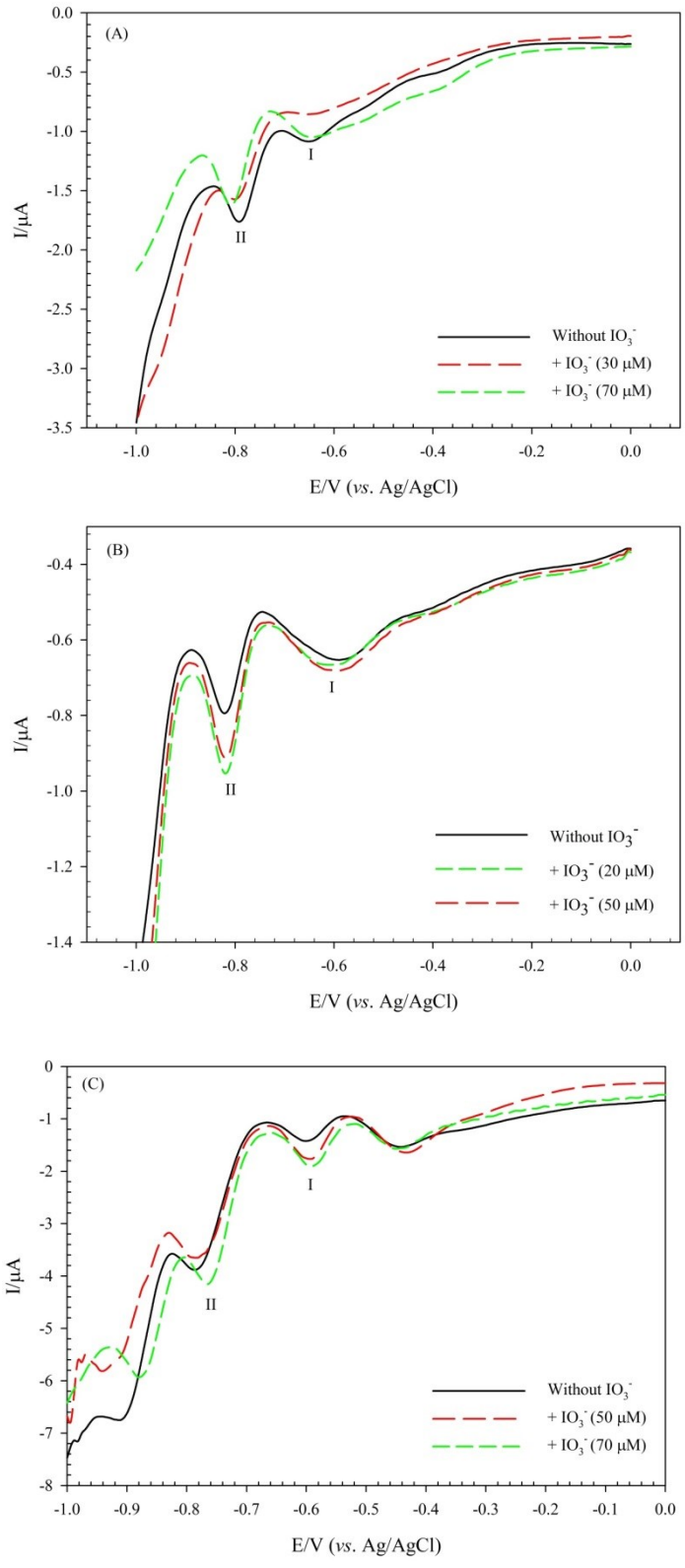


**Figure S3** SWV responses for the determination of $IO_3^-$ in (A) mineral water, (B) tap water, and (C) commercial edible iodized salt prepared in the $HClO_4$ solution (0.1 mol $L^{-1}$, pH=1.5) at (bdpy)$SiW_{11}$Ni/P-ERGO/GCE); scan rate 50 $mVs^{-1}$.