Determine the Ni–Ni Bonding Strength in Metal-String Complexes Using Head-to-Head Nanorods and Electrochemical Surface Enhanced Raman Spectroscopy

Bo-Han Wu,[a] Li-Yen Hung,[a] Jheng-Yang Chung,[a] Shie-Ming Peng,[b] I-Chia Chen[a]*

[a]Department of Chemistry, National Tsing Hua University, Hsinchu 30013, Taiwan, Republic of China
[b]Department of Chemistry, National Taiwan University, Taipei, 106, Taiwan, Republic of China

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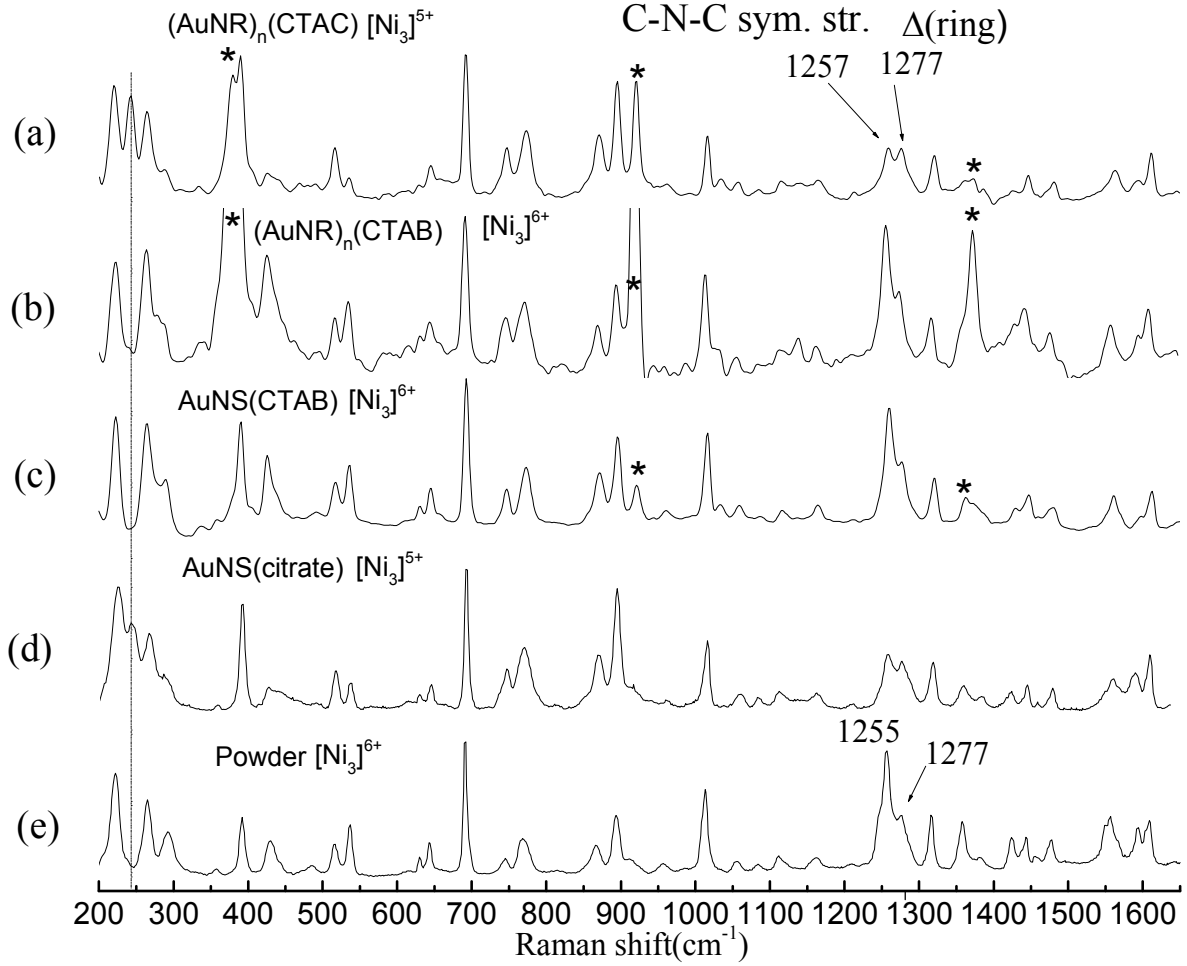

Figure S1. Full SERS Spectra of (a) AuNR(CTAC), (b) AuNR(CTAB), (c) AuNS(CTAB) and (d) AuNS(citrate) $Ni_3(dpa)_4(NCS)_2$ in solution and (e) full Raman spectrum of $Ni_3(dpa)_4(NCS)_2$ in solid crystals. Asterisk denotes band from acetonitrile.

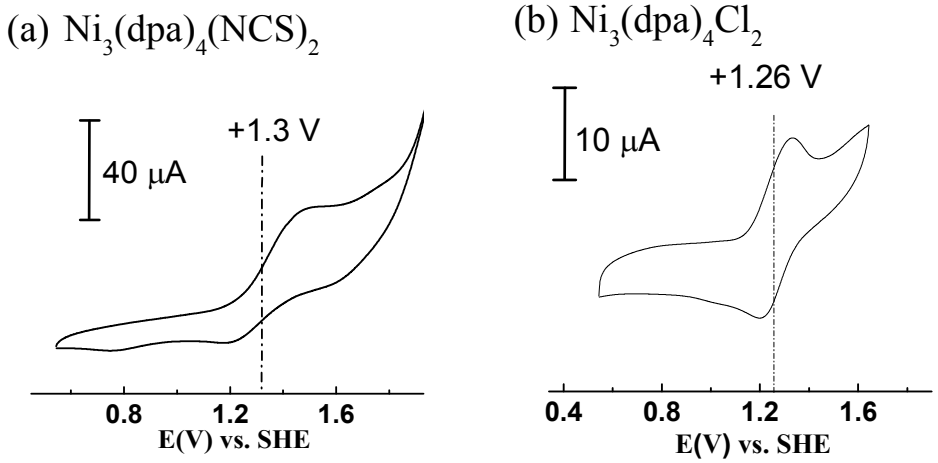

Figure S2. Cyclic voltammogram of (a) $Ni_3(dpa)_4(NCS)_2$ and (b) $Ni_3(dpa)_4Cl_2$ adsorbed on AuNPs in 0.1 M TBAP/DCM.

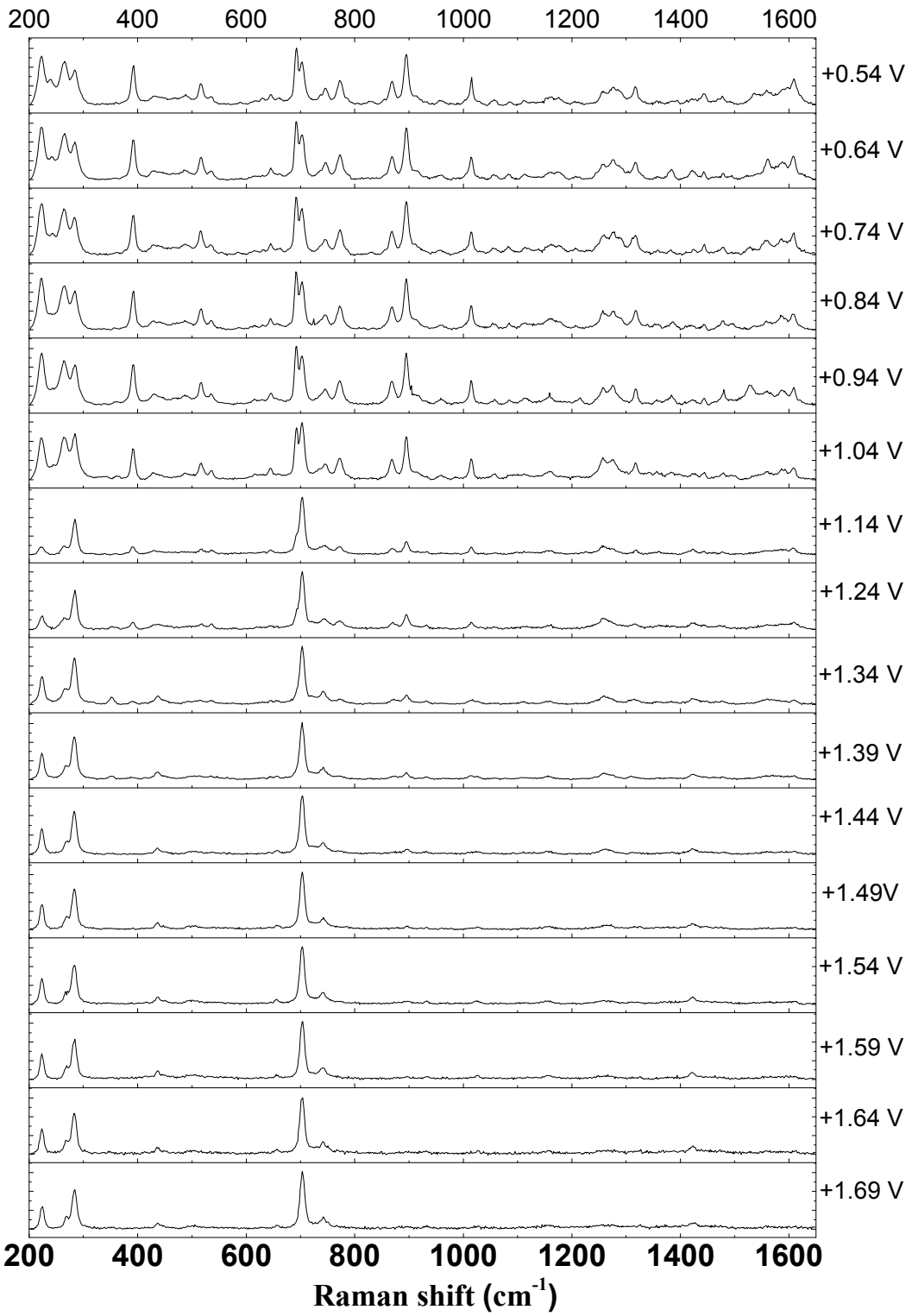

Figure S3. Full ECSERS spectra of $Ni_3(dpa)_4(NCS)_2$ from 0.54 V– +1.69 V.

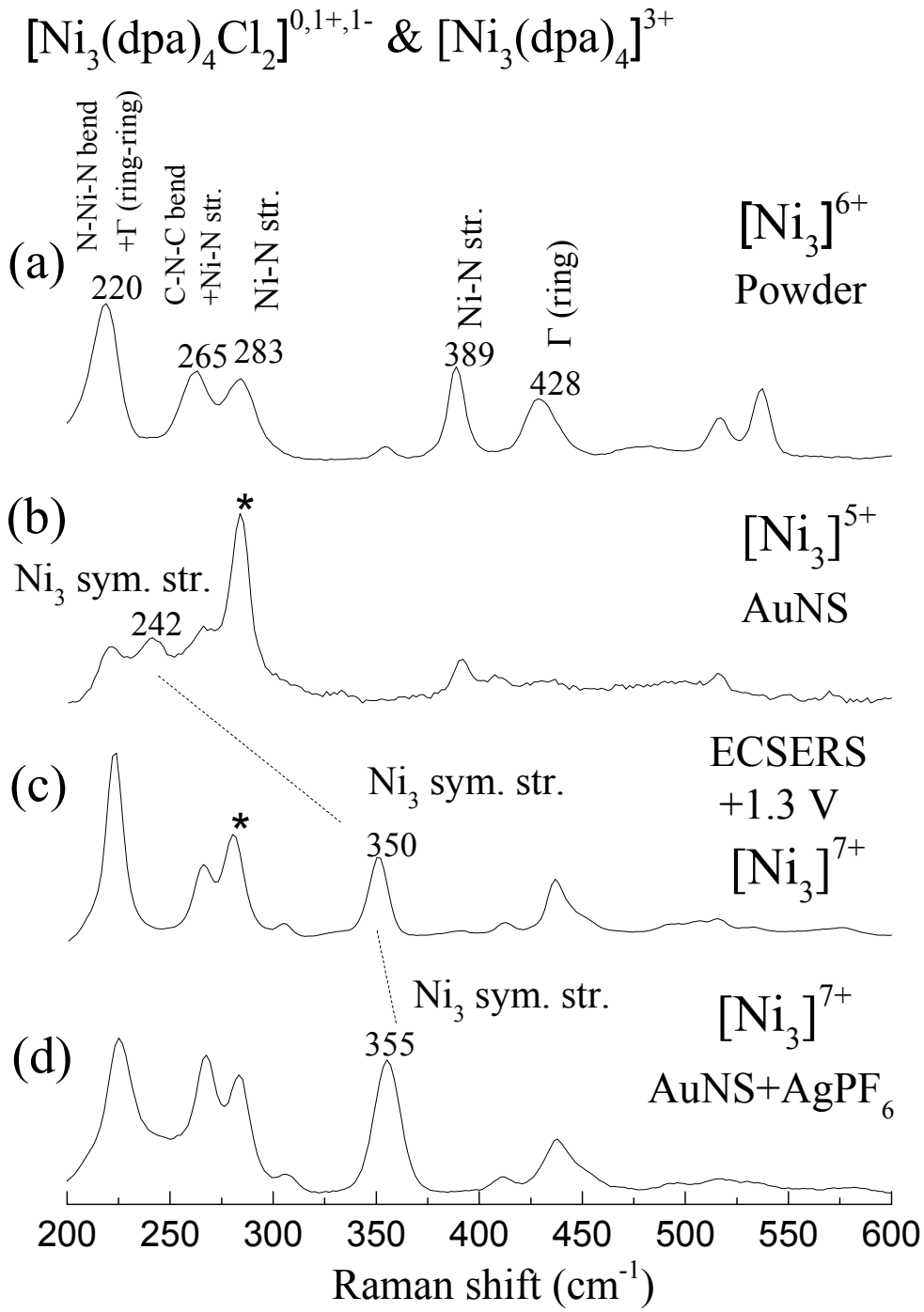

Figure S4. (a) Solid state Raman curve, (b) AuNP SERS, (c) ECSERS at +1.3 V, and (d) AuNP SERS with $AgPF_6$ added of $Ni_3(dpa)_4Cl_2$. Asterisk sign denotes bands from dichloromethane (DCM). The assigned $[Ni_3]$ core is as indicated.

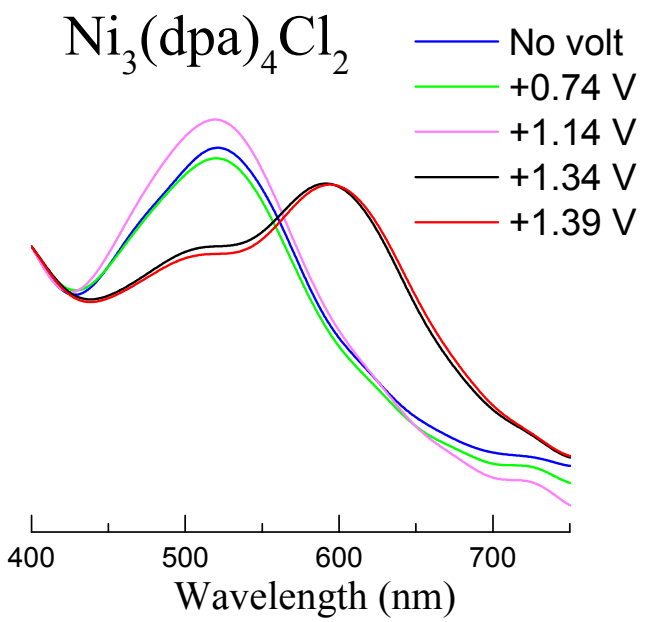

Figure S5. Absorption spectra of $Ni_3(dpa)_4Cl_2$ without and with applied voltage at +0.74, +1.14, +1.34, +1.39 V in 0.1 M TBAP/DCM.

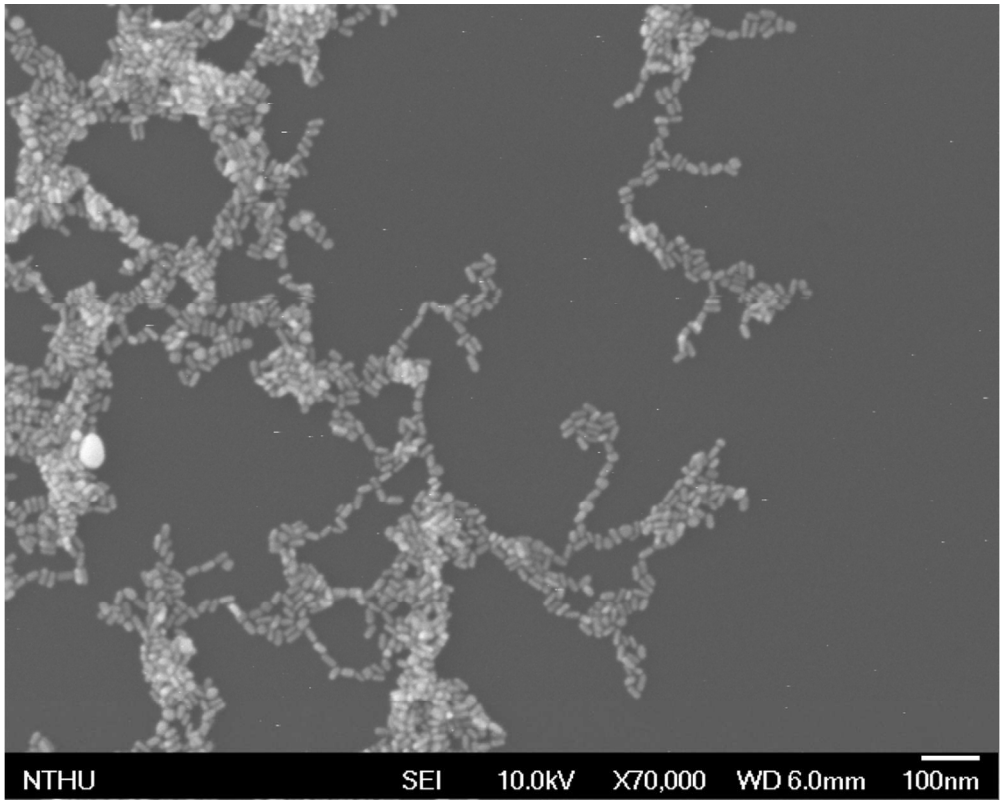

Figure S6. SEM image of AuNR(CTAB) with $Ni_3(dpa)_4(NCS)_2$ as the bridging molecules. The scale bar is 100 nm.

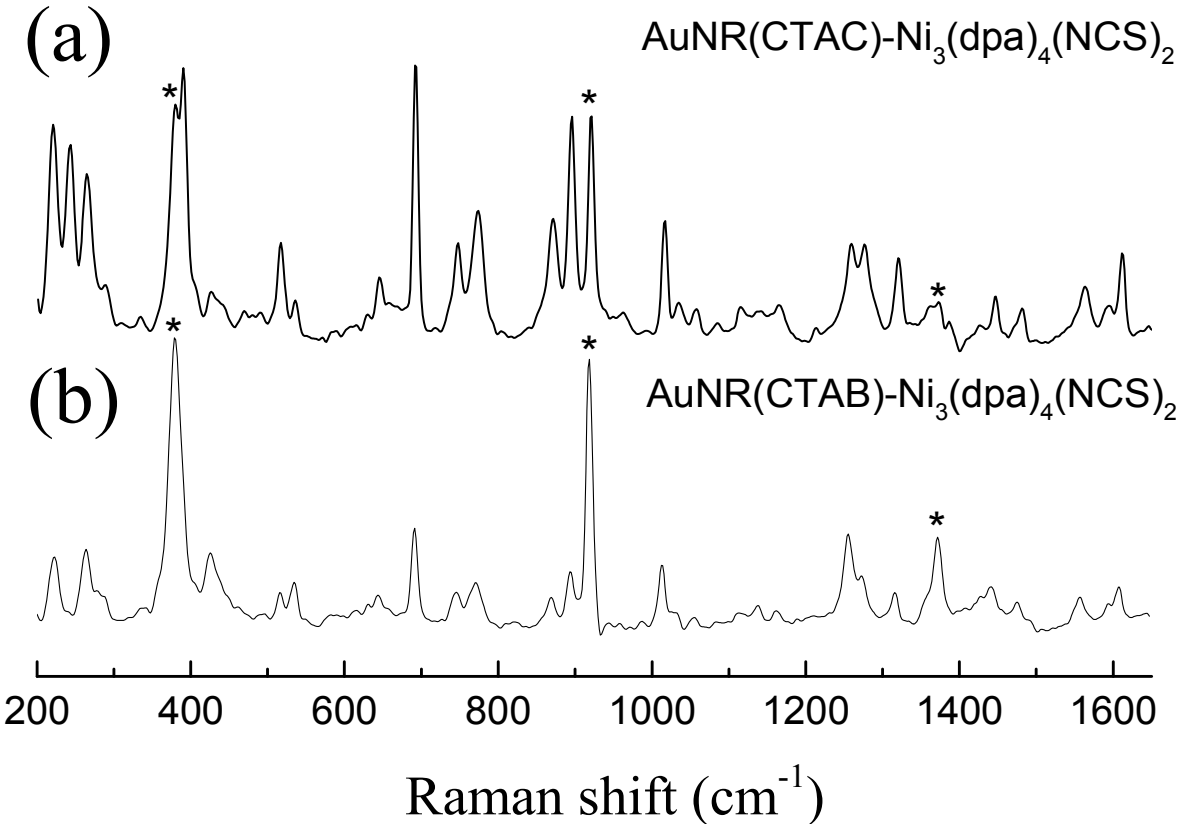

Figure S7. SERS of $Ni_3(dpa)_4(NCS)_2$ in (a) AuNR(CTAC) and (b) AuNR(CTAB). Asterisk denotes band from acetonitrile.

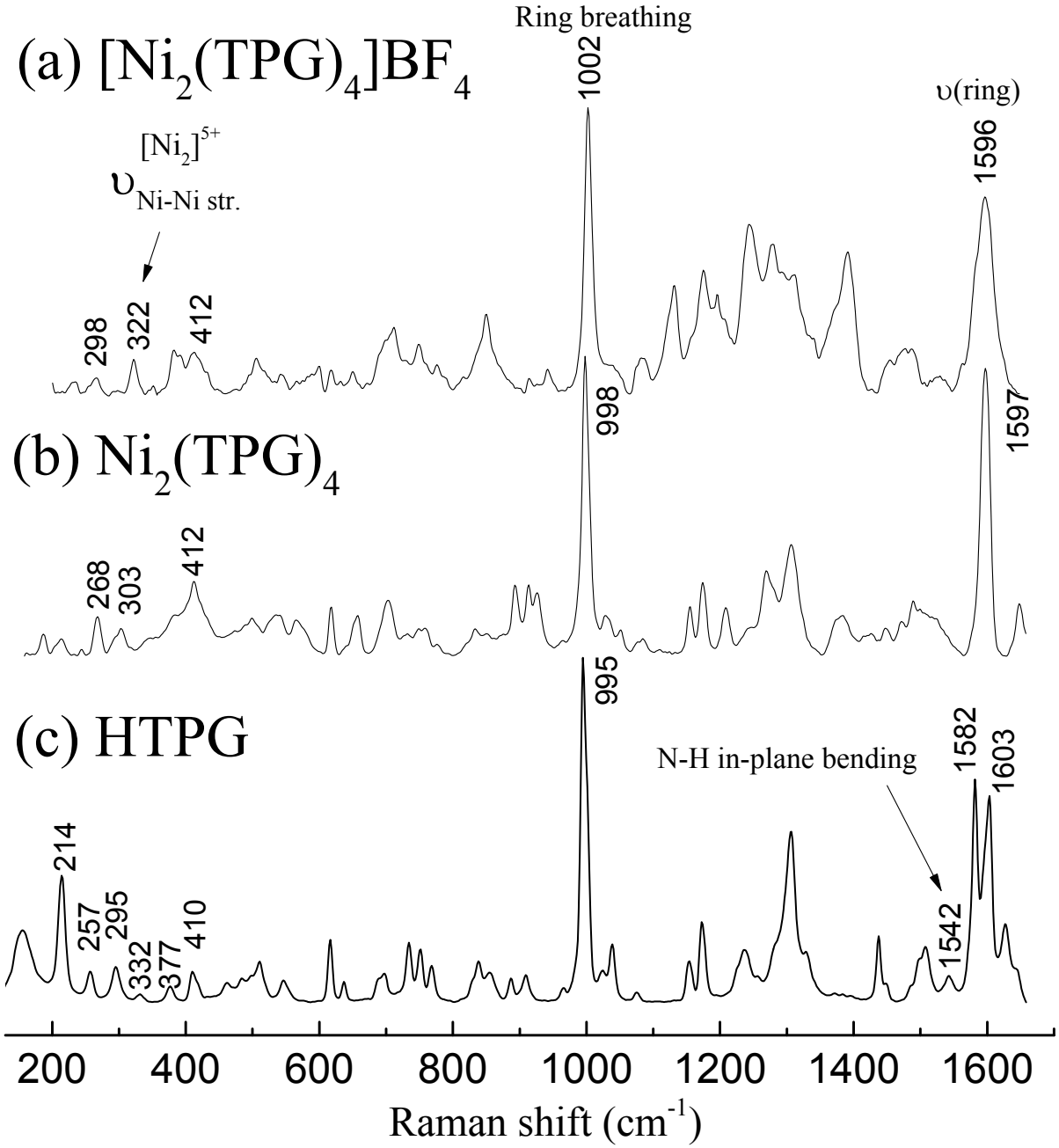

Figure S8. Full Raman spectra of (a) $[Ni_2(TPG)_4]BF_4$, (b) $Ni_2(TPG)_4$, and (c) HTPG with 633 nm excitation.