Control of Short-wave IR Transparency Using a Liquescent Bis(maleonitriledithiolato)nickelate(III) Salt

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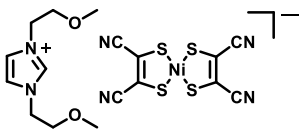

Ni-1

Materials absorbing near-IR (NIR: 700–1000 nm) and short-wave IR (SWIR: 1000–2500 nm) light have been used for components of various practical applications. Recently, researchers have been focused on the materials changing in their photophysical properties in the NIR and SWIR ranges to meet sophisticated technologies. Open-shell species are considered as one of candidates because of a wide range of absorption and their dynamic association/dissociation properties. Our research group has recently reported that liquescent radical cation showed drastic changes in NIR absorption/transparency accompanying with solid-liquid phase transitions.[1] In this contribution, we have designed and synthesized new open-shell anionic salt, bis(maleonitriledithiolato)nickelate(III) salt **Ni-1**, and found that it shows two-step changes in NIR and SWIR absorption/transparency accompanying with the phase transitions (Figure 1).

Nickel salt **Ni-1** showed a broad NIR/SWIR absorption in the solid state. Upon heating, the solid transformed to a liquid state at 76 ºC. The absorption above 1600 nm in the liquid state at 90 ºC was weaker than that in the solid state at 25 ºC. Additionally, the absorption in SWIR range could be further reduced upon further heating to 130 ºC. These changes were repeatedly observed by heating and cooling. Single-crystal XRD analysis and magnetic susceptibility revealed that these three stage changes were attributable to the dynamic dissociation and association of the aggregation states of the nickelate species.

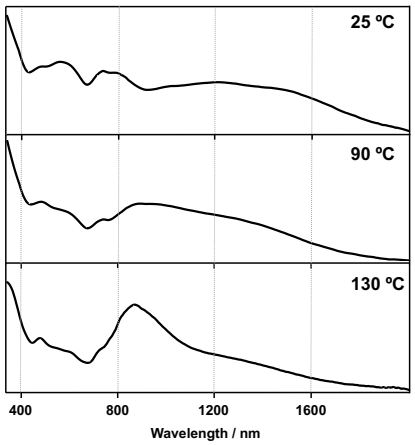

Figure 1. Electronic spectra of **Ni-1** under neat conditions at 25 ºC, 90 ºC and 130 ºC.

1) Suzuki, S.; Yamagichi, D.; Uchida, Y.; Naota, T. *Angew. Chem., Int. Ed*. **2021**, *60*, 8284.