Investigation of degradation factor for lithium-sulfur batteries by quantitative determination analysis using UV-vis spectra

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Lithium-sulfur (Li-S) battery is expected for next generation rechargeable battery owing to have high capacity (1,645 mAh/g). The key issues of Li-S battery for cycle performances are the dissolution of lithium polysulfide as Li2Sx. If we can suppress the dissolution of Li2Sx, the battery life should be extended. Solvate ionic liquid (SIL) is mixture of 1:1 complex from low-molecular weight ether and Li salt, which have high thermal/electrochemical stabilities owing to strong interaction of between ether oxygen and Li cation. Also SIL electrolyte can suppress the dissolution of Li2Sx. Recently, high Li salt concentration more than conventional SIL into electrolyte is important for high performance LIBs and Li-S batteries not only the high stability but also low Lewis basicity of electrolytes for low solubility of impurity with charge/discharge. Fig. 1 shows cycle performance of LiNi1/3Mn1/3Co1/3O2 | [Li(G3)x]TFSA | Li cell. Excess Li salts achieved high cycle performances and stable charge-discharge operations [1]. However, quantitative analysis for dissolution of Li2Sx into SIL has not investigated. In this study, to make clear relationship between composition ratio and dissolution of Li2Sx, saturated solubilities of Li2Sx were measured by electrochemical and UV-vis spectra. Given amounts of glyme (G3,tryglyme) and LiTFSA of 10:8, 10:9, 10:10, 10:9 and 10:8(molar ratio) were prepared. Mixture of S8 and Li2S (S8:Li2S=7:8, Li2S8) were prepared. Fig. 2 shows appearances of five LiTFSA concentration SILs with saturated Li2S8. Then oxidize Li2S8 to S8 and quantitative analysis using UV-vis spectra were carried out. In the presentation, we will report to results of electrochemical and UV-vis spectra, and correlation of between dissolution amount of Li2Sx and battery performances.

Reference: