Carbon Monofluoride (CFx) for Li/CFx Batteries

Lithium/Carbon Monofluoride (CFx) batteries are very attractive because they offer very high-energy density, long-storage life, very good safety record, a wide temperature operating range, and very low self-discharge. These batteries are found in a wide range of applications for military, aerospace, electronics, and medical customers. Carbon nanospheres made by hydrothermal synthesis at CAER have been fluorinated and tested as CFx cathodes. The fluorinated carbon nanospheres were tested in two electrolytes: 1M LiBF$_4$ in PC:DME (1:1), and 0.5M LiBF$_4$ in PC:DME (2:8). The measured capacity of the fluorinated carbon nanospheres is 832 mAh/g @ 1.5 V in 0.5M LiBF$_4$ PC:DME (2:8) which is close to the theoretical capacity of 850 mAh/g. The fluorinated carbon nanospheres have energy density of 2052 Wh/kg and 4000 Wh/L at an operating voltage of 2.6V, which is considerably higher than MnO$_2$ (847 Wh/kg, 4235 Wh/L), and SO$_2$ (1150 Wh/kg, 1650 Wh/L) systems currently available today. We are in the process of developing ordered carbons for CFx that can graphitize at much lower temperatures than 2500 °C. Also, we are developing subfluorinated disordered carbons that may serve as CFx cathodes.

Figure 1. Discharge profile of fluorinated carbon nanospheres in 1M LiBF$_4$ PC:DME (1:1) and 0.5M LiBF$_4$ PC:DME (2:8)