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PROPERTIES AND APPLICATION OF GRAPHITE FLUORIDE, $(C_2F)_n$

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Graphite fluoride is classified into $(CF)_n$ and $(C_2F)_n$ types from the structure and composition. $(CF)_n$ has been already synthesized industrially in fairly large quantities and utilized as an excellent cathodic depolarizer in lithium organic electrolyte batteries. Furthermore, many researches on the application have been carried out in comprehensive industrial fields such as lubricant, water repellent, mold release agent, etc.

On the other hand, a new type of graphite fluoride, $(C_2F)_n$, is also expected as the promising new material in a wide variety of industrial fields. However, it had been not produced to date on an industrial scale.

Central Glass Co., Ltd. has further developed the industrial technology for mass production of $(C_2F)_n$ and has been brought it to the stage of plant construction, in addition to $(CF)_n$.

In this paper, the properties and the applications of $(C_2F)_n$ will be reported in comparison with those of $(CF)_n$.

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ON THE DISCHARGE REACTION MECHANISM IN GRAPHITE FLUORIDE-LITHIUM BATTERIES

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The mechanism of discharge reaction of (CF)n and $(C_2F)n$ cathodes of lithium batteries utilizing 1 M $LiClO_4$-propyrene carbonate(PC) systems were studied by means of X-ray diffractions, XPS, NMR, and DSC.

Discharged products showed new peaks, that is, C(1s) binding energy is lower than that of C-F covalent bond and F(1s) binding energy is between C-F covalent and ionic bond in LiF. The linewidths of F-19 NMR decreased with increasing discharge percentage and narrowness of linewidths was observed in the temperature range between 293 and 105 K. These results obviously indicate the presence of an intermediate compound, namely fluorine environments on the discharged products are different from those of graphite fluoride and LiF. X-ray diffractions and DSC diagrams revealed that discharged products were solvated and disproportionated to give carbon with less crystallinity and LiF. Based upon these results, it seems most reasonable to conclude that the discharge reaction is the formation of solvated ternary compounds of (C·F·Li)·PC or (C2·F·Li)·PC of which electrical conductivity is considerably high. These are reasons why OCV observed is lower than the EMF value calculated from the free energy of formation of LiF and the enthalpy of formation of (CF)n but discharge potential is high and quite stable with high utility.