Stabilities, Hydrolysis Reactions, and Further Fluorinations of $C_{60}F_x$ Compounds

Olga V. Boltalina,* Ilya N. Ioffe, Yurii A. Makeev, Nadezhda I. Denisenko, Alexey A. Goryunkov, Vitalii Yu. Markov, and Alexey S. Streletskii

Department of Chemistry, Moscow State University, 119899 Moscow, Russia

We report recent results on the reactivities, thermodynamic stabilities, and structures of fluorinated derivatives of [60]fullerene. A series of reactions of the fluorinating agents F_2, XeF_2, MnF_3, or K_2NiF_6 with samples of $C_{60}F_x$ ($18 \bullet x \bullet 46$; single compounds or mixtures of compounds) were carried out. At temperatures below 300°C and with XeF_2, F_2 or K_2NiF_6 as the fluorinating agent, the most abundant product had the composition $C_{60}F_{46}$. In contrast, in the temperature range 300–350°C and with XeF_2 or MnF_3 as the fluorinating agent, the only composition observed was $C_{60}F_{36}$. The stabilities of various fluoro[60]fullerenes towards hydrolysis in the presence of methanol, THF, chloroform, or toluene were studied at RT or 70°C. We will discuss possible mechanisms of reactions which, in the case of $C_{60}F_{36}$, led to the oxides and hydroxides $C_{60}F_xO_y(OH)_z$, and which, in the case of $C_{60}F_{18}$ or $C_{60}F_{48}$, yielded only compounds with lower F content. Available experimental, thermochemical, and structural data for various fluoro[60]fullerenes, along with theoretical calculations of their relative stabilities, will be discussed.