DYNAMIC JAHN-TELLER EFFECT AND MANY-VALLEY STRUCTURE OF ELECTRONIC SPECTRUM AS POSSIBLE REASON OF HIGH-T_c SUPERCONDUCTIVITY OF DOPED FULLERITE A_3C_{60}

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The discovery of superconductivity with comparatively high critical temperatures $T_c \sim (20-40)$ K in crystal phase of fullerene C_{60}-fullerite, doped by alkali metal atoms A = K, Rb, Cs and Tl put a question about this phenomenon nature and its connection with high-T_c superconductivity in metal-oxides. Extraordinary rich vibrational spectrum of C_{60} molecules and respectively fullerite one that sweeps to frequencies $\omega \sim 2 \cdot 10^3$ cm^{-1}, and also the dependence of T_c on pressure and doping atom radii testify to phonon superconductivity mechanism in these organic compounds. But the question why is it absent in A_3C_{70} crystals which phonon spectrum is even richer remains unclear.

In this paper it is shown (see also [1]) that the main reason for high-T_c superconductivity in A_3C_{60} may be the high symmetry of C_{60} molecules (buckyballs) and cubic fullerite crystals A_xC_{60} at stoichiometric ($x = 3$) composition. Charge states of C_{60} molecule reveal Jahn-Teller deformation, therefore additional (may be rather strong) electron-phonon interaction with deformation vibrational C_{60} molecule modes (dynamical Jahn-Teller effect) appears in A_3C_{60} fullerite. Such a deformation interaction is accompanied by splitting of the partially degenerate conduction band, what also promotes electron-phonon coupling strengthening.

One more mechanism of this interaction strengthening and respectively T_c increasing in cubic A_3C_{60} (or $RbTl_2C_{60}$) crystals is their electronic spectrum many-valleyness. According to the numerical calculations [2] in fullerite conduction band there are 8 equivalent two-fold degenerate valleys in L-points and 6 non-degenerate (but more deep) ones in X-points of Brillouin zone. As is well known, intervalley interaction [3] and intravalley Cooper pairing [4] results in essential increasing of electron-phonon interaction, what qualitatively accounts for the rather sharp maximum in T_c at stoichiometric doped fullerite composition.

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