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Two different ground states in K-doped polyacenes SATOSHI HEGURI, QUYNH PHAN THI NHU, HIROYUKI TAMURA, Tohoku University, TAKEHITO NAKANO, YASUO NOZUE, Osaka University, KATSUMI TANIGAKI, Tohoku University, AIMR TEAM, DEPARTMENT OF PHYSICS TEAM, OSAKA UNIVERSITY TEAM — The electronic states of potassium (K) doped zigzag-type polycyclic aromatic hydrocarbon (polyacenes (PLAs)) K_x(PLAs), are studied for a series of the four smallest molecules: naphthalene (NN), anthrance (AN), tetracene (TN), and pentacene (PN), focusing on their 1:1 stoichiometric phases. Clear experimental differences are identified between the first group (K_1(NN) and K_1(AN)) and the second group (K_1(TN) and K_1(PN)) by magnetic, vibrational, and optical measurements. The first group is categorized as a Mott insulator with an antiferromagnetic ground state with energy of c.a. 10 meV, while the second group is classified as a band insulator via dimer formation due to the spin Peierls instability. In the latter system, the first thermally accessible triplet states are located far apart from the singlet ground states at room temperature, and are not detected by electron spin resonance spectroscopy until 300 K, being very different from what is observed for hole doped PN reported earlier. The results give a new systematic understanding on the electronic states of electron doped PLAs sensitive to the energetic balance among on-site Coulomb repulsion, band width and the Peierls instability.

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