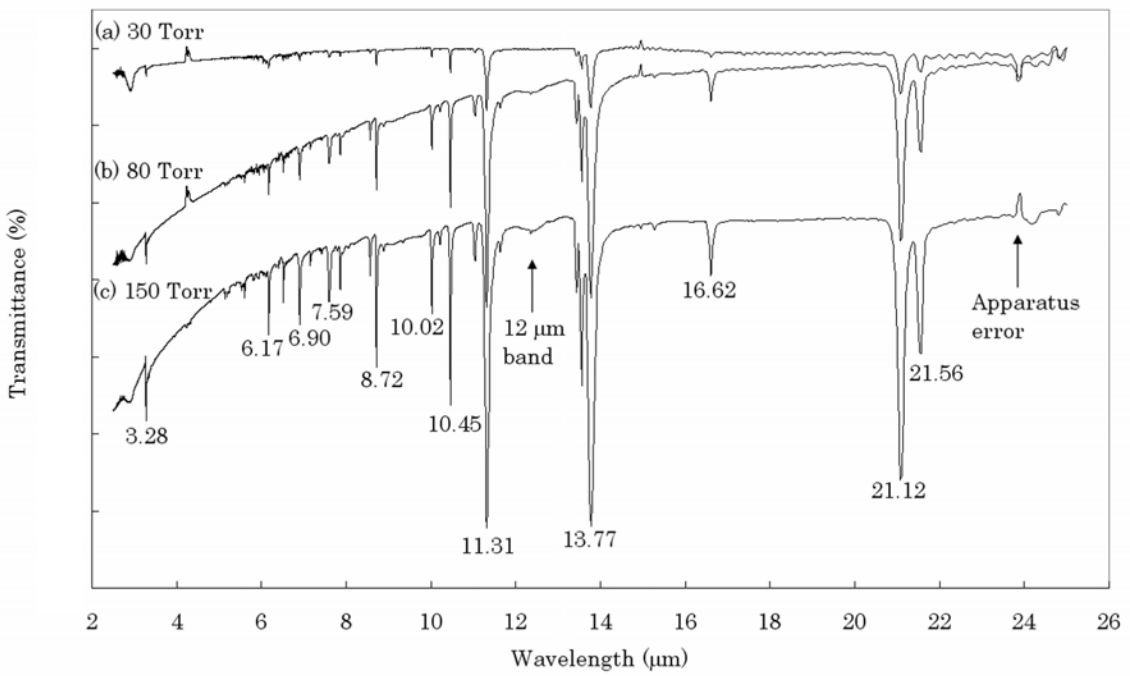

Fig. 2. Mid- IR spectra of anthracene clusters embedded in KBr pellets produced in He gas of 30, 80 and 150 Torr, respectively, were measured with a Fourier-transform IR spectrometer (Horiba Inc. FT210). The energy resolution used for this work was 2 cm^{-1}. The numbers show corresponding peak position. It has seen that the 12-μm bands were grown as increase of the gas pressure. These spectra have been shifted.

AGB to the planetary nebula stage of evolution [4]. Recently, Rapacioli et al. (2005) have found the growth of this 12-14 μm plateau in the photodissociation regions with the increasing distance from the UV source [5]. They have given an interpretation to their results that 12-14 μm plateau is suggested to be carried by carbonaceous very small grains or PAH clusters, which are easily photoevaporated into free-flying PAHs. Our results that the 12-μm band appears and grows as anthracene clusters grow have given an important evidence, for the first time in the laboratory experiments, such that the 12-14 μm plateau does originate in PAH clusters although our anthracene clusters have much more C atoms. This result may suggest that the origin of the plateau at 12-14 μm is not required PAH clusters constructed by large or mixture molecules.

Influence of UV irradiation: The anthracene clusters produced in He gas of 80 Torr were irradiated by UV at 254 and 365 nm for 15, 40 and 60 hours. The intensities at 254 and 365 nm of UV lump is 61 and 74 mW/cm^2, respectively. In the case of irradiation at 254 nm, almost all features shown in Fig. 1(b) such as at 8.72, 10.02, 10.45, 11.31, 13.77, 21.12 and 21.56 μm were gradually decreased as increase of the irradiation time. In contrast, many different bands at 8.19, 8.62, 9.70, 10.59, 12.27 and 14.64 μm were newly appeared and the band at 16.62 μm was shifted to 16.72 μm and became intense. In the case of irradiation at 365 nm, those peaks were similarly changed as 254 nm irradiation whereas the changing was very fast compared with 254 nm. The features were completely disappeared by irradiation at 365 nm for only 15 hours, although initial bands had been remained after 60 hours of 254 nm irradiation. Namely, the wavelength at 365 nm was more affective to anthracene clusters than 254 nm in spite of weaker energy. Anthracene has roughly two absorption features at 210-290 and 310-440 nm in the range of 200 to 800 nm. The irradiated two different wavelengths correspond to the central wavelength of their absorption features. This result implies that the alteration of PAHs by radiation of UV is depending on the wavelength. Similar experiments have been performed to understand the growth mechanisms and optical properties of PAHs and their clusters using other PAHs, such as naphthacene, naphthalene, pyrene, chrysene and coronene.

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