The infrared spectra of iron oxides particles

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The mysterious 21 μm emission feature seen in C-rich proto-planetary nebulae remains unidentified since its discovery in 1989 (Kwok, Volk and Hrivnak, 1989), and the candidate carriers have long been the subject of discussion.

Over a dozen of materials are suggested as the carrier candidates such as TiC nanoclusters (Von Helden et al. 2000), magnetite (Fe_3O_4) and maghematite (γ-Fe_2O_3) (Cox 1990), FeO (Posch et al. 2004) etc. Among many carrier candidates, FeO nano particles closely matche the observed 21 μm emission features and seems to be a viable candidate (Zhang et al. 2009).

As for FeO (wustite), the optical constants were derived with the reflectances of synthesized FeO bulk (Begemann et al. 1995, Henning and Mutschke 1997). But, fine particles of FeO were not synthesized by gas evaporation method in laboratory until now. We tried to synthesize fine particles of FeO and iron oxide particles in laboratory controlling O_2 gas pressure. These fine particles were analyzed with TEM and were measured with infrared spectra.

In order to compare to infrared spectra of the synthesized iron particles, we measured the infrared spectra of iron oxides particles of standard samples such as magnetite, hematite, wustite, and maghemite. We discuss about 21 μm feature compared with the results of synthesized iron oxide particles.