Decomposition behaviour and morphology change of noble metal oxide by ultrasonic irradiation

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Ecology and Economy synthesis is important in the future. There are some elements to achieve this synthesis. One is a production device. A cheap device is hoped for in not an expensive, special device but the general purpose. The second is a raw material. When synthesizing, neither waste nor the air pollutant are not generated, and it is safe and nontoxic raw material is preferable. The third is a synthetic temperature. Low temperature synthesis as much as possible is suitable from the viewpoint of energy conservation (e.g. room temperature). We developed a new metal micro and nano particles synthesis method that achieved these elements. This new synthesis method is with the ultrasonic cleaner as a general-purpose device and the metal oxide (M₂O₃) and alcohol (C₂H₅OH) are used for the raw material. Because it is home appliance, the ultrasonic cleaner is cheap. Moreover, the oxide and alcohol generally are cheap without toxicity. We have synthesized noble metal micro and nano particles by ultrasound in liquid-solid (EtOH-noble metal oxide) slurry and investigated decomposition behaviour and morphology change of powder. The synthesis technique is very easy. EtOH and the noble metal oxide powder are put in the beaker and the ultrasound wave only irradiated. Before irradiation, metal oxide peaks are detected in XRD. However only metal peaks are observed clearly after irradiation. These observations mean that noble metal oxide reduced into metal by ultrasonic irradiation at room temperature. Morphology of noble metal particles is changed by ultrasonic irradiation time. In the case of Ag₂O, it was decomposed to Ag by ultrasonic irradiation and it has become small by irradiation time (Fig 1). On the contrary, Au₂O₃ was decomposed to Au by ultrasonic irradiation and it has become large by short irradiation time. These phenomena can be applied to synthesis various materials. In presentation, we explain these decomposition behaviour and morphology change by ultrasonic irradiation in details and introduce some applications (alloy, composite and nanoparticle fabrications (Fig.2)).

Fig. 1 SEM images of the particle sizes and the shapes of (a)Ag₂O starting powder and (b)irradiation product.

Fig. 2 TEM image of Ag nanoparticle.

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