

課題番号 :2018B-E06

利用課題名 (日本語) :その場雰囲気での分散型 X 線吸収分光実験による PdRu および PdRuM(M=Rh,Ir) 固溶合金ナノ粒子の三元触媒反応機構解明

Program Title (English) :Catalytic reaction on PdRuM(M=Rh, Ir) alloy nanoparticles studied by time-resolved dispersive X-ray absorption fine structure spectroscopy

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キーワード : Energy-dispersive X-ray absorption fine structure, PdRuIr nanoparticles. Oxidation and reduction reaction.

1. 概要 (Summary)

Rhodium (Rh) is one of the most important metals in the industry, which is used as a catalyst for exhaust gas in automobiles. Because Rh is a rare and expensive element, the development of Rh alternatives composed of abundant elements is desirable. To reduce the Rh metal for three-way catalysts (TWC), we synthesized the PdRuIr NPs on the various oxide supporter to apply the TWC. We have carried out the thermal stability of PdRuIr NPs on the oxide supporter using the *in-situ* energy-dispersive X-ray absorption fine structure (DXAFS) measurement. The behavior of the atoms in the PdRuIr metal in the redox reaction was confirmed.

2. 実験(目的,方法) (Experimental)

DXAFS experiment was carried out the BL14B1 of SPring-8, Japan. Dispersive X-rays were achieved by a Si (422) bent crystal with a Laue configuration. An incident X-rays with energy dispersive source focused to sample position. Samples were placed in a furnace and performed to oxidation (oxygen gas)/ reduction (H₂ gas) reaction experiments as a function of annealing temperature. A ramping rate of temperature was 10 K/min.

3. 結果と考察 (Results and Discussion)

Figure 1 shows the oxidation effects of PdRuIr NPs supported on LaFeO. It can be seen that the oxidation of Pd and Ru atoms occurred in the

temperature range of 200 to 400 °C. On the other hand, the oxidized state is maintained between 400 and 750 °C. For 750 to 1000 °C, oxidation of Ru atoms is increased, whereas Pd atoms are reduced.

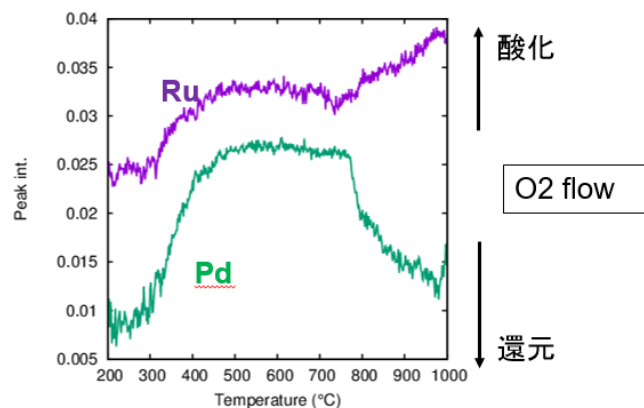


Figure 1. Peak intensity information of PdRuIr NPs supported on the LaFeO.

To investigate the reduction process of PdRuIr NPs, we were carried out the *in-situ* DXAFS experiments in He gas condition. In the H₂ gas state, it was confirmed that the oxidized Ru atoms were gradually reduced from 500 to 800 °C. Since Pd atoms remain in the metallic state from the beginning of reduction, it does not change basically.

4. その他・特記事項 (Others)

No