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Education

Ph. D. (March, 1986), M. Eng. (March, 1983), B. Eng. (March, 1981): Osaka University

Academic Carrier

- 1988 (June): Assistant Professor, Department of Applied Chemistry,
Faculty of Engineering, Osaka University
- 1995 (April): Lecturer, Department of Applied Chemistry, Faculty of Engineering,
Osaka University
- 2000 (May): Associate Professor, Department of Applied Chemistry,
Faculty of Engineering, Osaka University
- 2003 (March): Professor (Head of Laboratory of Inorganic Materials Chemistry),
Department of Applied Chemistry, Faculty of Engineering, Osaka University

Awards

- The Rare Earth Society of Japan Award for Young Scientists (1996)
- The Seiyama Award from Japan Association of Chemical Sensors (2001)
- The Yazaki Science Award for Young Scientists (2002)
- Ichimura Science Award (2005), The Ceramic Society of Japan Award for Academic Achievements (2005)
- The Rare Earth Society of Japan Award (2006)
- The Electrochemical Society of Japan Award for Academic Achievements (2007)
- Inoue Science Award (2008)
- Yazaki Science Award (2009), The Chemical Society of Japan Award for Creative Work (2009), etc.

Total Publications

Original papers 272, etc.

Research Interests

Main research fields are the area on Inorganic Materials Chemistry. Especially, ionic conducting solids, that is, solid electrolytes are one of main research field. Also, our interests focus on are rare earths and inorganic functional materials such as environmental catalysts, environmentally-friendly pigments, novel fluorescence materials, and chemical sensors applying the solid electrolytes.

Nitrogen Monoxide Direct Decomposition on C-type Cubic Rare Earth Oxide Catalysts

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Nitrogen oxides (NO_x) are harmful to the environment as well as human beings. Among various NO_x removal methods, direct catalytic decomposition into non-toxic O₂ and N₂ is one of ideal ways, because the process is simple and any reductants are not required. The predominant NO_x species in the emitted gas at elevated temperatures is thermodynamically stable nitrogen monoxide, NO, and, accordingly, the research should be shed a light on the NO direct reduction.

We have already demonstrated that C-type cubic rare earth oxides hold high direct NO decomposition activities. The C-type cubic structure has large interstitial open space in its crystal structure with oxide ion vacancies, which plays a significant role in the direct NO decomposition, and the catalytic activity can be enhanced by partial substitution of the trivalent rare earth ion sites with divalent Ba²⁺ ions to produce further oxide ion vacancies. In our previous studies, we have identified that C-type gadolinium oxide, Gd₂O₃, is one of suitable candidates among the C-type cubic rare earth oxides.

Here, yttrium oxide (Y₂O₃), which holds a thermally stable C-type cubic oxide, was employed as the base oxide, and the Y³⁺ ion was partially replaced by Tb^{3+/4+} to promote the direct NO decomposition activity by supplying additional re-dox characteristics of multivalent terbium ion.

On the present (Y_{0.69}Tb_{0.30}Ba_{0.01})₂O_{2.99+δ} catalyst, complete, that means 100 % NO direct decomposition into O₂ and N₂ was successfully realized at 900 °C. Furthermore, the high NO decomposition activity was maintained as high as 64 %, even in the presence of 10 vol% O₂ at the same operating temperature.