**Table IV**

**Comparison of the Reactivity of Supported Palladium SMAI and CI Catalysts for Benzene Hydrogenation[a]**

| Catalyst | Rate of benzene hydrogenation, per cent/h/g of Pd | Conversion of benzene, per cent |
|---|---|---|
| 1.39% $Pd/Al_2O_3$ (SMAI) | 696 | 13.5 |
| 1.39% $Pd/Al_2O_3$ (CI) | 0 | 0 |
| 1.50% $Pd/ZrO_2$ (SMAI) | 66 | 1.3 |
| 1.50% $Pd/ZrO_2$ (CI) | 0 | 0 |
| 1.56% Pd/MgO (SMAI) | 498 | 9.8 |
| 1.56% Pd/MgO (CI) | 20 | 0.4 |
| 1.65% $Pd/TiO_2$ (SMAI) | 599 | 12.0 |
| 1.65% $Pd/TiO_2$ (CI) | 0 | 0 |

[a] Reaction Conditions: initial hydrogen pressure 30 atm, reaction temperature 140°C, reaction time = 4.5 h, Reactor: autoclave (170 $cm^3$)

of SMAI and CI catalysts leads to the conclusion that the SMAI catalysts exhibit a much higher reactivity and selectivity than CI catalysts for the hydrogenation of benzene and the methanation of carbon dioxide. The highly active properties of the SMAI catalysts can probably be attributed to the presence of residual carbonaceous fragments which surround the small metallic crystallites, highly dispersed particles in metallic form and a higher degree of reduction of the supported palladium. However, for carbon dioxide methanation, a study of catalytic stability shows that the highly active SMAI catalysts have very poor stability compared with the corresponding CI catalysts. The explanation for the shorter life of the SMAI catalysts remains obscure; however, it may be related to the adsorbed acidic carbon dioxide species which affect the decomposition of metallic form particles (clusters) during the reactions.

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# Aluminium-Ruthenium High-Temperature Alloys

In a continuing search for materials that combine strength, toughness and oxidation resistance at high temperatures, a variety of intermetallic compounds have been considered. A simple screening test identified aluminium-ruthenium, iridium-niobium, ruthenium-scandium and ruthenium-tantalum as worthy of investigation and some of the properties of these tough binary alloys were presented here in July 1992.

A further communication on the properties of aluminium-ruthenium alloys has now been published (R. L. Fleischer and D. W. McKee, "Mechanical and Oxidation Properties of AlRu-Based High-Temperature Alloys", *Metall. Trans. A*, 1993, **24**, (3), 759–763).

The authors confirm the interesting properties of $Al_{47}Ru_{53}$ and $Al_{48}Ru_{51}Y$, which combine low oxidation rates at 1100°C with good mechanical properties at room temperature. $Al_{43}Ru_{52}Sc_5$ has good high-temperature mechanical properties, and at 1350°C the oxidation rate is only marginally unacceptable, indicating that the alloy may be useful at lower temperatures.