Development of Air-Floating-Like Easy-to-Slide "Mirror-Polished Diamond Slider"

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AIST tohoku has developed a mirror-polished diamond slider with a low friction coefficient close to air-floating conditions. A coating technique has been established for Chemical Vapor-Deposited (CVD) diamond film onto machinable titanium silicon carbide. This technology affords a much improved degree of freedom in selecting the shape of the substrate.

The superior sliding performance is attributed to the mixed lubricant effect resulting from a combination of the solid diamond lubricant and the fluid lubricant brought about by the intervening air. It becomes also possible to use a machinable titanium silicon carbide as the substrate for diamond deposition. Until the present, fabrication of CVD diamond has only been possible on flat substrate surfaces or for small cutting tools. With the new technology, however, it will be possible to use this process for coating any shape of sliding surfaces. In the past, the suitable materials as substrates for CVD diamond were limited to brittle silicon or very hard silicon carbide and silicon nitride, or tungsten carbide that are heavy and difficult to machine.

The newly developed diamond sliding surface essentially presupposes the use of a diamond-to-diamond combination. At low contact pressures, however, it is also possible for the diamond surface to mate with a metal surface, since the diamond film will provide a smooth air-floating like sliding performance also with machined surfaces such as stainless steel.

CVD diamond slider put on a stainless steel guide.

Innovation in Chemical Reactions using a Supercritical Water Microreaction System

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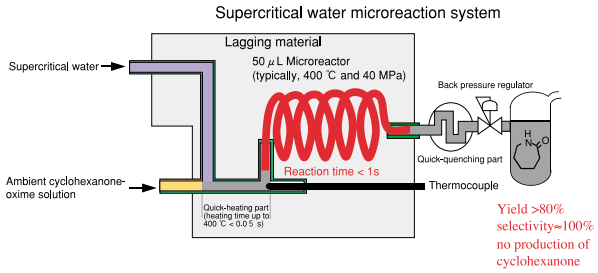
The Beckmann rearrangement into ε-caprolactam is one of the most industrially important acid-catalyzed reactions, which is the starting monomer for the production of nylon 6. However, its practical production has suffered from serious disadvantages of using environmentally damaging catalysts such as highly concentrated sulfuric acid and of forming large quantities of valueless by-products such as ammonium sulfate. We demonstrate that our supercritical water microreaction system can achieve a high selectivity in a satisfactory yield for the ε-caprolactam production even in the absence of any acids.



Supercritical water microreaction system