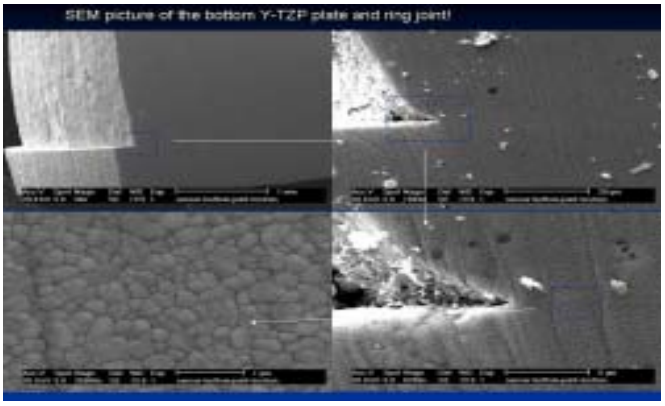
Argonne NATIONAL LABORATORY

Office of Technology Transfer

A novel method of joining advanced materials

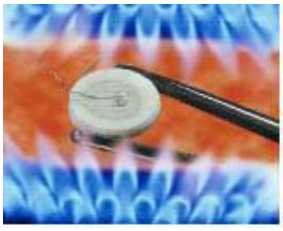
Scientists at Argonne National Laboratory have developed a method of joining a number of advanced materials, such as ceramics, intermetallics composites, cermets and others, that results in an "invisible seam" that has strength equal or greater than that of each of the joined materials separately.

Creating complex shapes in ceramic materials is notoriously difficult. Often, the process involves forming such shapes in the 'green state' and subsequently sintering to form the finished ceramic. An alternative is to machine an already sintered ceramic blank into the required shape, however this is an expensive and time consuming process. Another technique involves joining pieces together by brazing or welding. However the resulting joints often have poor mechanical properties compared to the materials being joined and the temperatures necessary limit the usefulness of this technique.



The process that Argonne researchers used to join such materials is called "superplastic deformation." In this process, multiphase materials, such as ceramics can be joined seamlessly, without the need for expensive, difficult to find equipment. A further key fact in the developed process is that the joint is as strong as the materials which it unites and can be used with or **without** a joining compound between the layers.

The figure to the left shows an example of such a joint at four levels of magnification. As the magnification is increased to resolve the individual material grains within the joint (lower right) it can be seen that the seam is indeed invisible!



The first application of this method, developed in collaboration with researchers at Ohio State University, has resulted in a novel high temperature potentiometer oxygen sensor with an internal reference electrode. This technology was recognized by R&D 100 magazine as one of the best technologies of 2005.

Public Patent Documents

US 2003/0029910 A1: Joining of Advanced Materials by Plastic Deformation

For More Information

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