J Material Sci Eng 2014, 3:3
http://dx.doi.org/10.4172/2169-0022.S1.017



## Stable glass-ceramic composites a compliant seals for SOFCs

**M H Imanieh**
University of Toledo, USA

In order to develop compliant seal systems for SOFCs operating in the temperature range of 800-950°C, this project has focused on iterations in materials systems. The materials consisting of composites of a base glass with appropriate ceramic components in order to identify a stable sealing system with adequate and acceptable thermal characteristics, such as, the viscosity and coefficient of thermal expansion. Appropriate viscosity was targeted to ensure good flow behavior of the glass at temperatures where fuel cells operate and sealing effects are required. Viscosity variation in the composites was brought about by the selection of ceramic additives; a large number of candidates ranging from phase pure alumina, magnesia, ceria and barium zirconate, to ceria doped with 10 mole % gadolinium oxide (GDC). SCN1 glass (trade name of sealing glass developed by SEM-COM) was used as the base component, whose composition was such as to provide a CTE match with the SOFC system (in the RT-Tg range), when composited with a second ceramic phase. Additives in both nano- and micro-scale dimensions (as fine powders or in the form of fibers) were introduced mainly to block the bubbles from moving but also to make the composite structure stronger. In addition, their role was also to inhibit the growth of air bubbles within the glass matrix and to or prevent their coalescence during long soak-time at 850°C, with the goal of eliminating or minimizing the CTE drift in the resultant glass composition. No reaction between SCN1 glass and the GDC additives was discerned. Moreover, the bubbles remained small and did not move or coalesce. The CTE of the GDC composites was very close to the targeted value and not change significantly when aged up to 232 h at 850°C in air.

### Biography

M H Imanieh obtained a PhD in Materials Science from the University of Science and Technology at Tehran, Iran in 2012. He is working as a postdoctoral research fellow in the department of chemical and environmental engineering; where he is involved in the synthesis, processing, development and characterization of glass formulations as seal materials for fuel cells. His research is focused on Stable Glass-Ceramic Nanocomposites as Compliant Seals for SOFCs and finding new materials for chemical looping combustion process. He has several years of experience in the glass and glass ceramic area. Much of his work has been devoted toward bringing innovative glass ceramics materials. He has authored 10 journal papers.

mahammad.imanieh@utoledo.edu

## Designing a hybrid adsorbent/photocatalyst to produce solar fuels from $CO_2$ reduction with $H_2O$

**Lianjun Liu**
University of Wisconsin-Milwaukee, USA

Photocatalytic conversion of $CO_2$ with $H_2O$ is a promising technology to recycle $CO_2$ back to renewable fuels. The major obstacle, however, is the lack of efficient catalysts that can simultaneously adsorb, activate and dissociate $CO_2$, and facilitate the products/intermediates desorption from the catalyst surface. To meet these requirements, a new hybrid adsorbent/photocatalyst, $MgO/TiO_2$ or $TiO_2$/MgAl-layer double hydroxides (LDHs), was designed to adsorb and convert $CO_2$. This multifunctional material demonstrated a greatly enhanced and more stable activity than pure $TiO_2$ for CO production from $CO_2$ photoreduction at a slightly high temperature (150°C). The effects of surface MgO dispersion and $CO_2$ adsorption/desorption dynamics have been investigated. In situ diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) study was used to identify surface intermediates and to understand the reaction pathways. The in situ DRIFTS analysis suggested that bicarbonate is a potential intermediate for CO production, and the dynamics of $CO_2$ adsorption/desorption is a critical factor to govern the activity and stability of the hybrid.

liul@uwm.edu