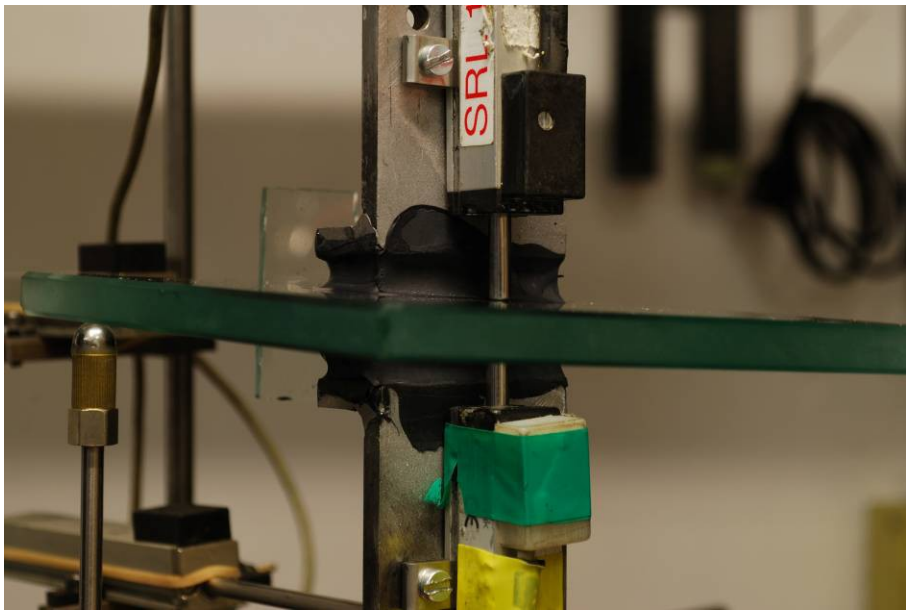
	Project sheet
Research project :	Novel Glass-to-Metal and Glass-to-Glass Structural Joints for Architectural Applications
Images :	
Keywords :	Connections, Adhesives,
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Time span :	2009 – 2013 (proposed)
Description :	The invention of the Planar system by Pilkington 35 years ago brought about an unprecedented level of 'architectural transparency' as it enabled glass panels to be bolted together by means of specially developed stainless steel fixings thereby eliminating the need for the traditional mullions and transoms. As a result, bolted glass assemblies, often referred to as structural glazing, have become very popular, and several manufacturers have since launched their own version of the system. Bolting glass does however have its limitations. A bolted connection is arguably one of the least structurally efficient ways of connecting brittle materials as it induces high stress concentrations around the bolt hole which glass is unable to redistribute by plastic flow. Furthermore, the high stress concentrations around the bolt hole coincide with the region containing large surface flaws caused by the drilling process and with the area where glass tempering is least effective. Other disadvantages of bolted glass assemblies are the additional cost of drilling the holes in the glass which must be carried out before tempering and once assembled the bolt itself is a source of cold-bridging in façade applications. Recent developments in liquid phase and solid phase bonding of ceramics provide a timely opportunity for developing a new generation of glass-to-metal and glass-to-glass joints that outperform the current bolted connections. Furthermore, bonding eliminates the need for bolt holes thereby offering visual and manufacturing advantages as well as cost and energy savings. Initial tests on simple glass-to-metal and glass-to-glass adhesives at the University of Cambridge have shown that adhesive connections provide a substantial improvement over their mechanical counterparts and on-going tests on the long term performance of these joints are equally encouraging.

	Further research is however required to improve the long term performance of the adhesives identified so far. For example there is a timely opportunity to use sol-gel processing to devise adhesives that are hydrophobic, self-repairing and better suited to accommodate the thermal expansion of the adherends. Further research is also required to characterise the performance of these connections thereby improving our ability to predict their performance in real-world applications. Other direct bonding techniques recently developed for the ceramic industry may also be transferable to glass joints. These techniques such as low temperature brazing and diffusion bonding are largely untested on glass application, but are worth investigating further. The aim of this research is therefore to develop the next generation of fixings for glass assemblies based on high performance structural adhesives. The research will focus on the characterisation and development of reinforced adhesives for high strength, durable, aesthetically pleasing and economical metal-to-glass and glass-to-glass joints. In parallel other novel bonding methods such as microwave diffusion bonding, fluxless low temperature brazing and infrared radiation welding will also be investigated.
Most important publications :	- WATSON, JK; OVEREND, M; JIN, Q; LAI, W *Premature Failure in UV-Cured Adhesive Joints* ISAAG 2010 (confirmed but yet to be held)
Working group :	WG 4. Novel glass assemblies
Category :	Adhesive & other connections
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