

Methods of attachment for single crystal silicon (SCSi)

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Brittle materials, such as single crystal silicon are not like ductile materials that allow threading and direct mechanical attachment to other materials, therefore a need exists for process innovations. McCarter provides attachment of brittle materials to metal through the use of metal inserts, bonded with glass frit powder, which serves as the interface between the brittle material and the metal. This paper will cover both rigid and flexural insert designs.

In some cases, glass frit bonding joints, referred to as metallurgical joints, show promise in replacing mechanical joints and/or metal inserts. The glass frit bonding of SCSi to SCSi provides this metallurgical joint that distributes stress over the interface area thereby minimizing local stress concentrations. This process enables complex and/or large SCSi systems.

Previous work with glass frit from the Babylonians to the Argonne National Lab LS249 (1995) test report set the ground work for the advancement that McCarter Technology (1996-present) is now providing for building SCSi systems for extreme environments with minimum blur, jitter and/or creep. McCarter's first lightweight SCSi mirror was delivered to NASA Goddard in 1999 and has remained unchanged in figure as of 2013, the date of this paper.

Biography

Douglas R. McCarter has been an invited speaker for organizations such as MDA, NASA, SPIE, ESTO, COSPAR and NSMMS. After obtaining his certification as a Machinist and Millwright, he co-founded McCarter Machine Inc., dba McCarter Technology in 1981 with his wife Eloise. Douglas is an inventor of manufacturing processes using silicon and author and resulting owner of US Patent 6,443,817 "Method of finishing a Silicon Part". He was awarded Lifetime Senior Member Status in the SPIE, Society of Professional Optical Society. He is recognized as World's Expert on Precision Silicon Components by ESTO, European Optical Society. He was appointed three year term on editorial staff of International Optic Periodical named "Advanced Optical Technology" (Germany). Since 1998, he has authored eighteen technical papers that have been presented at SPIE conferences. He has been highlighted in periodicals such as Forbes.com, Kiplinger, New Mexico Optics, Entrepreneur.com, NASA Tech Briefs and Missile Defense Briefs.

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