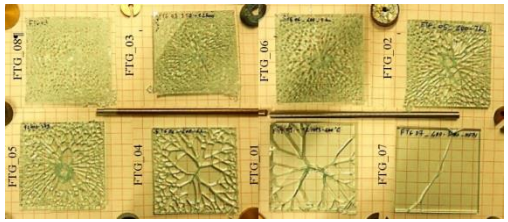
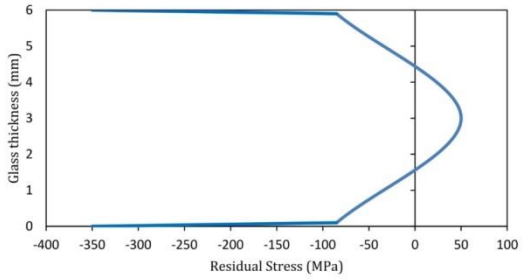
Level | ***PGR***





Bi-tempered Glass

Research Student | Marco Zaccaria
Supervisor | *Dr. Mauro Overend*

Overview | *In recent years glass has been used for structurally complex applications, with roofs and staircases becoming increasingly common. This has been possible due to post-production processes, such as tempering, which enhance glass properties significantly. Tempering can be thermal or chemical, induces a residual stress profile which characterise the glass with specific properties. The residual stress profile in thermally tempered glass enhances glass strength and generates a fragmentation characterised by small and relatively harmless fragments. The residual stress profile in chemically tempered glass enhances glass strength more than in thermally tempered glass, without affecting the fragmentation behaviour, which remains characterised by large and sharp fragments. An ideal glass that combines the strength of chemically tempered glass with the fragmentation of thermally tempered glass would be the product of choice for monolithic applications requiring high strength and safe fragmentation.*

Outcomes & Impact | *In order to achieve these properties the glass should be characterised by a stress profile obtained by the superposition of thermally and chemically tempered glass. To engineer the stress profile in such a way the process should consist of thermal tempering followed by chemical tempering and the product is called bi-tempered glass.*

Work involved | The project consists of two stages:

-Assessing how the residual stress profile affects glass properties; this involves an experimental work to determine the response in terms of strength and fragmentation of thermally and chemically tempered glass when the residual stress profile is known;

- Modelling how to engineer the stress profile to produce bi-tempered glass; this involves an analytical model, that combined with experimental test that predicts the residual stress relaxation and build-up occurring during the second step of tempering (i.e. chemical). The optimal conditions that maximise strength and fragmentation are investigated by means of destructive test and fragmentation test.

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