# Processing and mechanical characterization of materials for superconducting magnet impregnation

Jacob Bertsch
TE-MSC-SMT
Supervisor: Christian Scheuerlein
Technical Student
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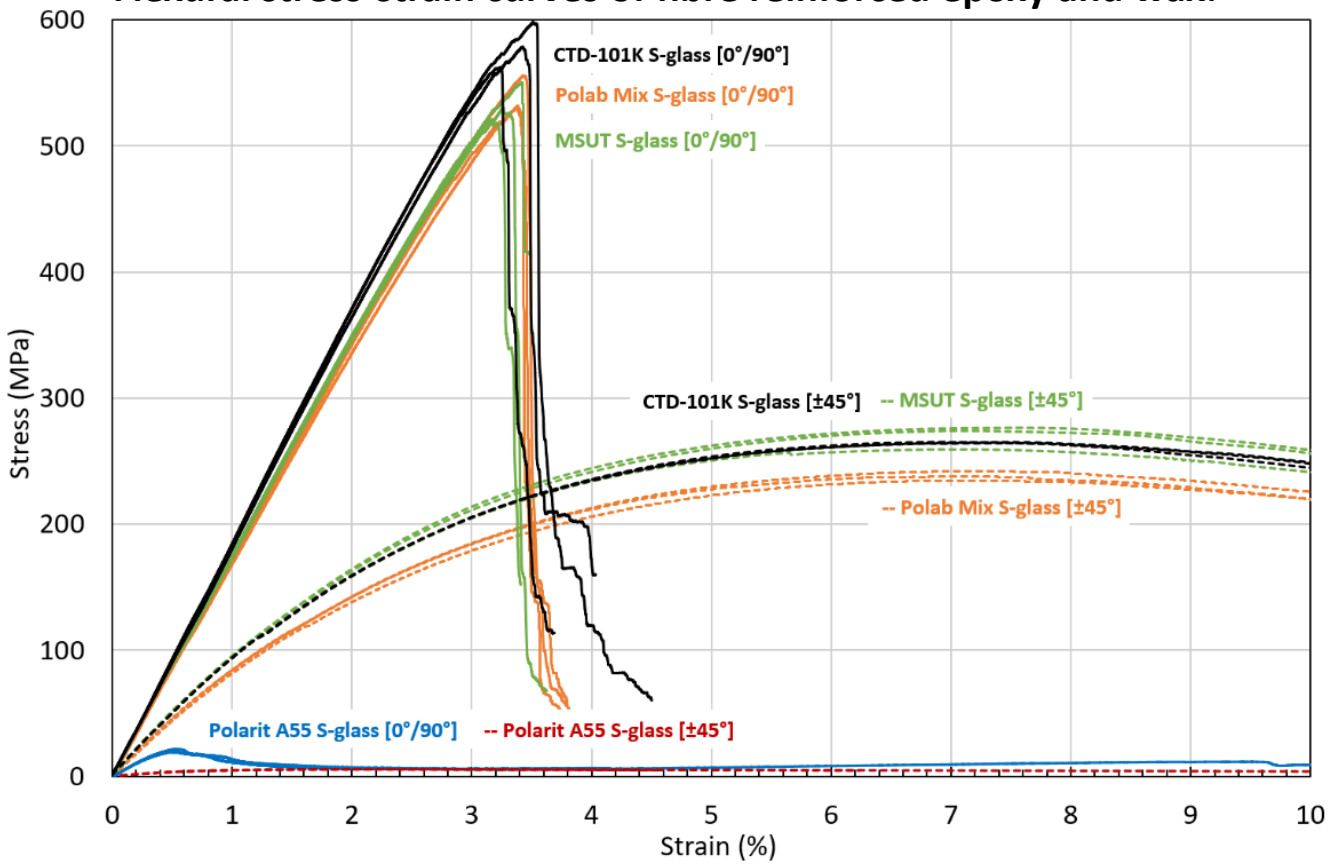
# Mechanical testing of fibre reinforced wax and epoxy resins

- **Development of a vacuum impregnation process using wax**
- Manufacturing of pure and fibre reinforced wax and epoxy resin samples
- Tensile, compressive, flexural, and impact testing at RT and 77K

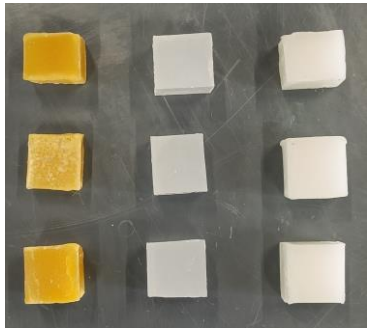
**Flexural stress-strain curves of fibre reinforced epoxy and wax:**

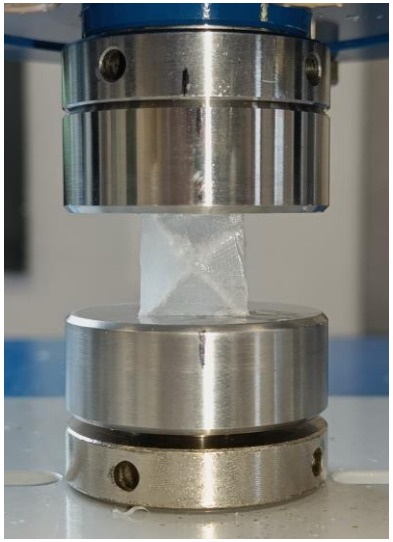


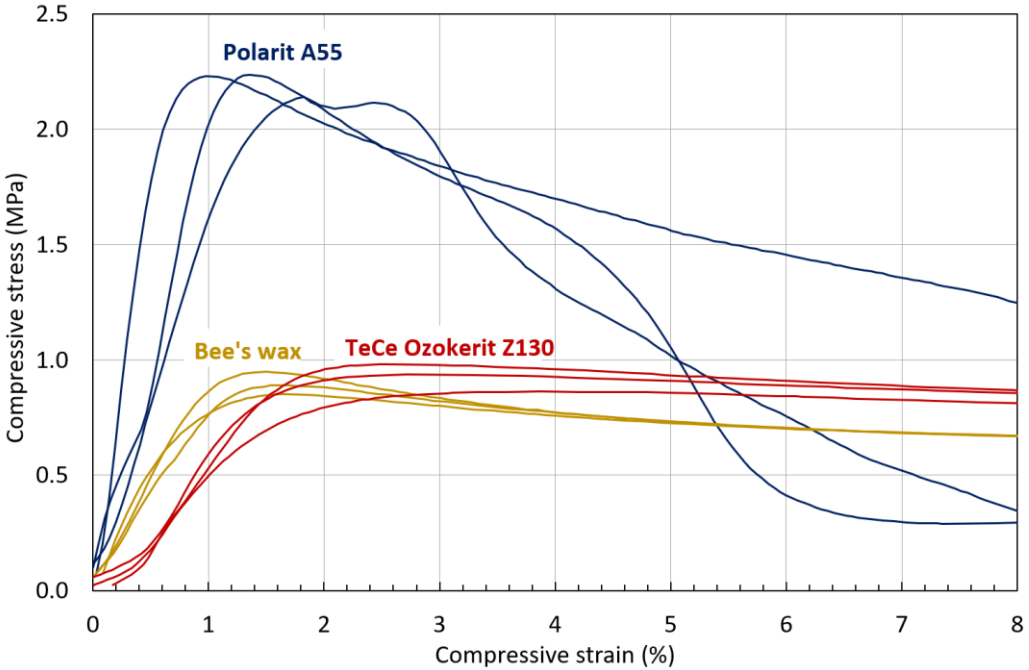


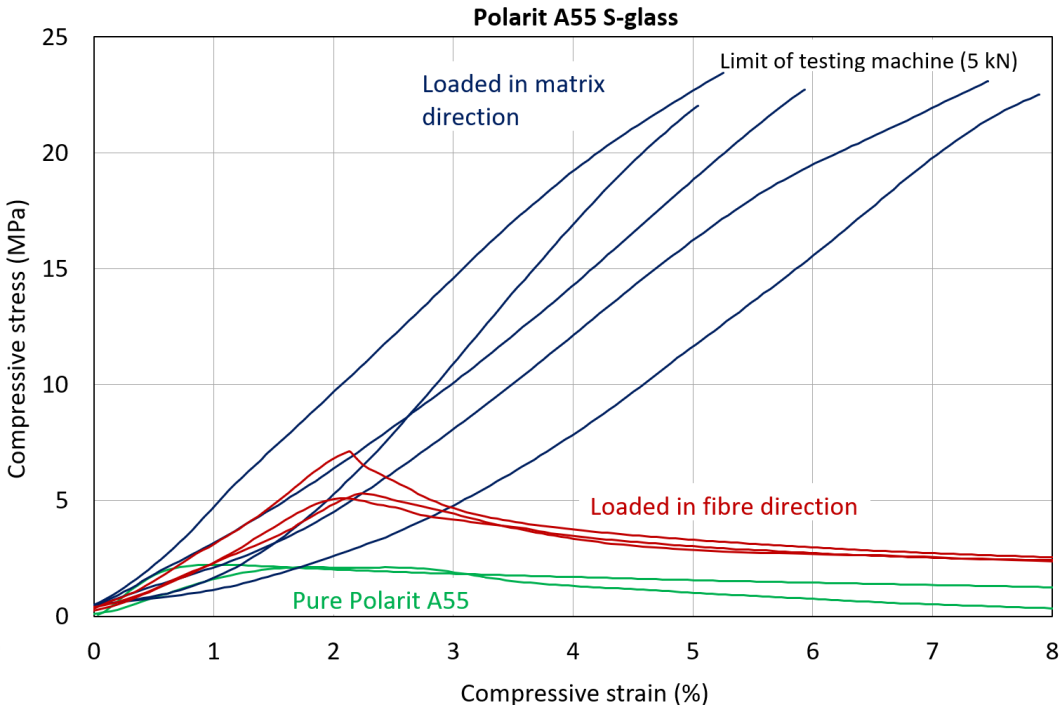

# Compressive testing of wax

- Compression of rectangular cubes ~ 15x15x15 mm
- 3 pure waxes and 1 fibre reinforced wax
- Strain calculated from machine position -> determination of modulus inaccurate
- Samples loaded in fibre direction fail from due to delamination
- Pure Polarit A55 shows shear failure
- Pure Bee's wax and Ozokerit Z130 wax fail due to yielding



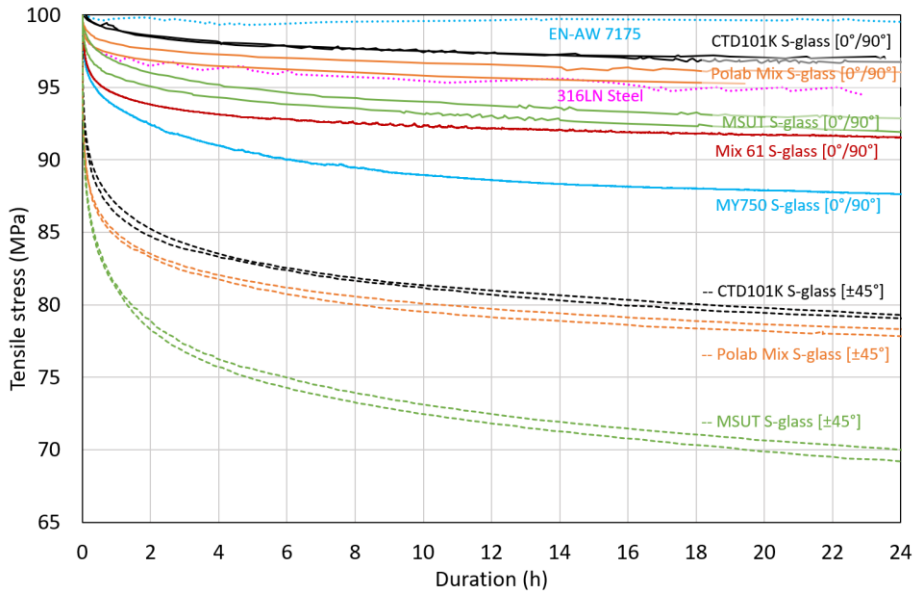




# Stress relaxation and impact testing of polymers

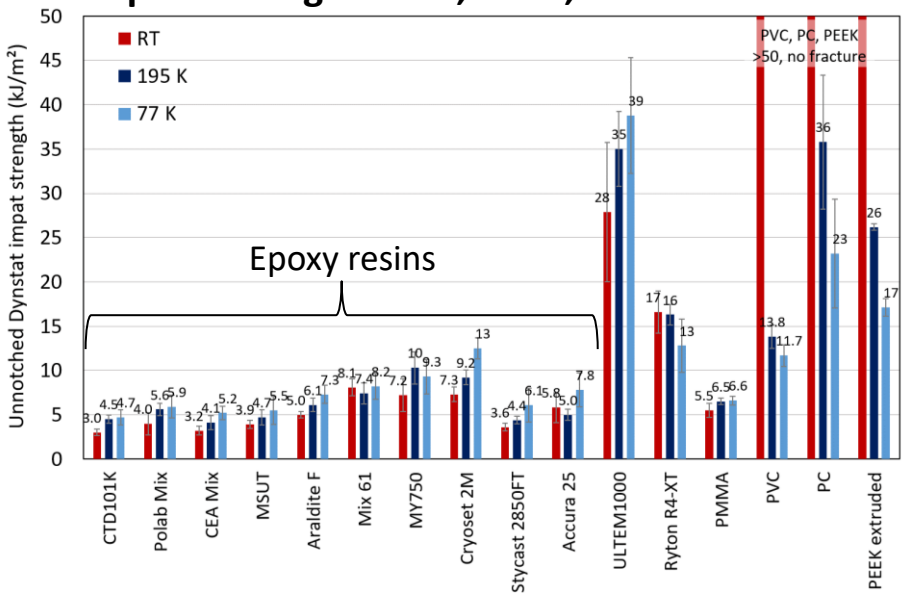
**Stress at constant strain as a function of time:**




**Applying 100 MPa uniaxial tensile stress, then holding sample strain constant**

- Even [0°/90°] fibre reinforced epoxy resins loaded in fibre direction lose pre-stress over time, the behaviour is affected by the matrix
- Significantly more stress relaxation when samples are loaded 45° to fibre orientation

**Impact strength at RT, 195K, and 77K:**




- Epoxy resins have comparatively low impact strength
- Impact strength of most tested epoxy resins seems to increases with decreasing temperature?
- Impact strength of most thermoplastics tested decreases with decreasing temperature