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M1Or3C-01 [Invited]: Resins for Superconducting Magnet Construction –An Overview of Requirements, Processing and Properties

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The resin used for bonding and insulating superconducting magnets can be a major factor in ensuring reliable and stable operation of the completed assembly. There are many resin systems and available to magnet designers and engineers. The selection of the correct material depends on the application technique selected, the processing requirements and the end properties required of the cured resin. Available techniques for magnet construction and bonding include vacuum impregnation (VPI), so called 'wet winding' and the use of pre-impregnated fabrics. The advantages and disadvantages of these techniques are considered and the processing requirements for each are discussed. Materials selection requires an understanding of the processing characteristics such as viscosity and 'useable lifetime' but these must be married with the properties required of the cured resin. A low viscosity and long useable life is a frequent requirement for VPI processing of large magnet systems and this may be difficult to match with high thermal shock resistance that may be required to minimize cracking possibilities in resin rich regions. Examples are presented of resin systems resistant to cracking and structural features that enhance this parameter. For many magnets that may operate in an ionising radiation environment, radiation stability is an important requirement. Radiation stable systems are described and structural features that promote such stability are considered, along with the difficulty of matching all competing requirements.

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