

Material studies for the ATLAS Phase-II Upgrade for the High Luminosity LHC: carbon fibre laminae measurements and investigation of moisture expansion of an adhesive used in support structures

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For the High-Luminosity Phase of the Large Hadron Collider, the current ATLAS tracking detector will be replaced by an all-silicon tracker composed of a pixel and a strip part. The strip tracker consists of silicon strip detector modules, composed of circuit boards with readout chips glued onto silicon sensors, which again are glued onto carbon fibre support structures. The support structures are composed of carbon fibre face sheets and honeycomb for mechanical stability, containing a titanium cooling pipe (for evaporative CO₂ cooling) enclosed in thermally conductive carbon foam. All support components are connected using a two-component glue (Hysol 9396), loaded with boron nitride for good thermal conductivity. In order to obtain reliable simulations of the mechanical properties of the complete support structures, the mechanical characteristics of the individual components need to be well understood. This contribution presents investigations of the mechanical characteristics of carbon fibre laminae as well of measurements of the expansion of adhesives due to moisture absorption. Discrepancies with traditionally used material property values are found and methods for their estimates in simulations are presented.

Summary

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