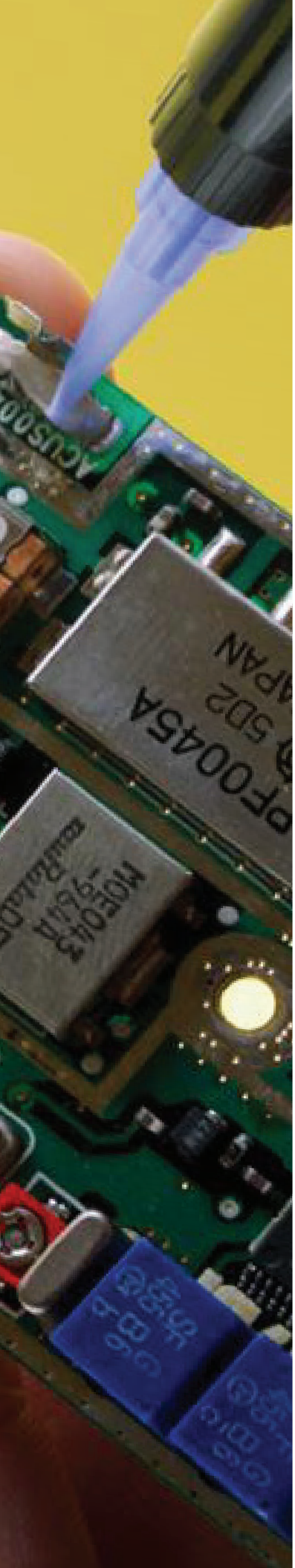

MASTERBOND®
CASE STUDY

EP79 Used to Connect Electrically Conductive Joints in the ATLAS Detector at CERN

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Overview of EP79

Master Bond EP79 is a two component, electrically conductive epoxy adhesive for bonding, coating, and sealing applications. After curing, it has low shrinkage, good bond strength, and toughness, making it suitable for thermal cycling over a wide temperature range. EP79 has been used in various applications in the semiconductor and electronics industries. Scientists at CERN used Master Bond EP79 to connect electrically-conductive joints while ensuring minimal radiation leakage and interference.

Application

ATLAS at the Large Hadron Collider at CERN is a particle detector used to record high-energy particle collisions to understand the fundamental interactions between ionizing particles.[1,2,3] The SemiConductor Tracker (SCT) is part of the ATLAS inner detector system and is constructed of a barrel and two end-caps. Each component of the SCT must resist damage by ionizing radiation generated by the collider to ensure proper performance. To accomplish this, the SCT barrel detector was encased in inner and outer thermal enclosures (a Faraday cage), which protected the detector against external electromagnetic radiation and provided a low-impedance path to prevent electromagnetic noise from interfering with the detector. Master Bond EP79 was chosen to ensure a gap-free seal in the joints of this grounding and shielding system.

Key Parameters and Requirements

To ensure the sensitive detection of ionizing particles, external electromagnetic noise must be prevented from reaching the detector. This includes sealing all joints in a gap-free manner by using an electrically-conductive adhesive. EP79 was used to reduce the radiation length and connect electrically-conductive joints of the aluminum barrel and copper end caps of the Faraday cage of the ATLAS detector. For such applications, it is recommended to cure EP79 overnight at room temperature, followed by 1–2 hours of post-curing at 150–200°F. It can also be cured at room temperature within 48–72 hours, or within 2–3 hours at 200°F.

Results

Due to its high sensitivity, the ATLAS detector can easily pick up noise from external electromagnetic radiation, so it must be enclosed in a Faraday cage. Due to design specifications, the Faraday cage had to be assembled from multiple pieces, including a barrel and two end caps, which necessitated the use of an adhesive to bond these pieces together. Care was taken to ensure that the joints of the cage, which included tin-plated Be-Cu radio-frequency gaskets, were without gaps and had minimal impedance. This required that all materials have a low impedance, including the adhesive. Master Bond EP79, which contains silver-coated nickel as the conductive filler, was chosen as the electrically-conductive adhesive. It helped minimize the impedance of the Faraday cage while simultaneously sealing gaps and seams, as confirmed by DC resistance measurements of the electrical joints, which showed no deterioration over time. Overall, the Faraday cage helped protect the detector from picking up noise, and in July 2012, CERN reported that the ATLAS barrel at the Large Hadron Collider was instrumental in the discovery of the Higgs Boson.[4]

References

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