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Internal strain responses of YBCO superconducting taps based using embedded and distributed FBGs under tensile，compression and bending loading

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Complex stress/strain can arise from the winding, cooling down and intense field in YBCO superconducting coils, which can induce maximum internal strain to several thousand micro-strain in coils. Thus, efficient production and operation of YBCO superconducting magnets will benefit from smart sensors that may be embedded within structure without damaging its structural integrity. Currently，most strain sensors are still not used in the YBCO coil for some reasons, such as intrusion, size and interference. In this work, using home-made soft polymer FBGs, internal strain distributed responses between two YBCO superconducting taps are investigated experimentally during tensile, compression and bending loading at room temperature and 77K. The internal and distributed strain responses during the complex loadings are recorded to show that measurement techniques have good precision and repeatability comparing with the theoretical ones. Compared to the common FBG，it is the most important that the distributed polymer-FBGs can be embedded softly in taps with good survival to measure the internal strain in the coils. The present results are expected to be able to provide basis methods on the internal strain of YBCO superconducting magnet/cable, which cannot be obtained using traditional strain sensors during fabrication and excitation of superconducting coils.

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