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Highly reinforced, low magnetic and biaxially textured super high tungsten Ni-W alloy composite substrates used in coated conductors

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Highly reinforced, low magnetic and biaxially textured super high tungsten Ni-W alloy substrates have been fabricated through composite substrate preparation method used in coated conductor applications. The content of tungsten exceeds 10% in the obtained substrates, which is the current world record. In this excellent super high tungsten substrate (Ni10W), it has a strong cube texture of 98.7%(<10°) as commercial Ni5W substrate, but overwhelming high yield strength of 310 MPa – twice of Ni5W substrate. Meanwhile, the saturation magnetization of the Ni10W substrate is only 4% of the Ni5W substrate. Furthermore, through the in-situ EBSD tensile observation of the stability of the strip, it is found that the grain orientation and grain boundaries of the substrate present very high stability up to 0.2 % strain, which is beneficial to the roll-to-roll preparation of the coated conductor. A CeO_2 buffer layer was successfully deposited on the super high tungsten substrates, which indicates that the substrates are suitable for REBCO coated conductors. The super high tungsten substrate with strong cube texture, high yield strength and negligible magnetization can significantly improve the progress of using the RABiTS route in the fabrication of REBCO tapes. Meantime, the mechanisms of the cube texture evolution and tungsten diffusion in super high tungsten substrate are also studied.

Keywords: Super high tungsten, Substrates, Coated conductors, Cube texture