

DESIGN AND TESTING OF ARAMID/NYLON REINFORCED COMPOSITE PIPES FOR LARGE-DEPTH HOT WATER DRILLING

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The Antarctic cold zone has given birth to a large number of closed subglacial lakes, and hundreds of subglacial lakes with large burial depths have been discovered, which may harbor unknown ancient life because they have been isolated from the outside world for millions of years. Subglacial lakes and sediments contain rich information on ice sheet evolution and paleoclimate. Therefore, the development of Antarctic subglacial lake drilling research is of unique and important scientific significance to the advancement of Antarctic glaciology, geology, and paleontology.

Hot water drilling is currently known to be an efficient drilling process that can rapidly penetrate ice. Fiber-reinforced composite pipe can be used as its core equipment, undertaking the key task of transporting high-temperature and high-pressure hot water. For this reason, we have independently developed an aramid/nylon fiber-reinforced thermoplastic composite pipe. Considering its transport of high-temperature and high-pressure media, we have conducted a high-temperature 90°C burst test as well as a tensile test on it. The results show that in a 90°C water environment, the composite pipe burst pressure can reach 53 MPa. At the same time, for the Antarctic low-temperature environment (which can reach -50°C), burst and tensile tests were performed after cryogenic freezing. The tests show that its maximum tensile load-bearing capacity can still reach 190 kN, and the burst pressure can be maintained at 53 MPa. The tests proved that the low-temperature environment does not cause performance attenuation of this aramid/nylon composite pipe. After summarizing the results of a series of tests, it is concluded that this kind of composite pipe can meet the needs of Antarctic hot water drilling, and it is expected to be formally applied to Antarctic on-site drilling operations in the next working season.

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