A Study on the Computer-aided Simulation of A390 Aluminum Brake Disk

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ABSTRACT

This study made use of the computer-aided engineering(CAE) analysis software to simulate the A390 aluminum alloy brake disk cast by CO2 sand mold and to find out the casting shrinkage defects. The simulation also tried to get the resolution of eliminating the defects by using different riser modulus and different chiller shape for the brake disk. In addition of computer simulation, the real brake disk castings were poured to be compared with the simulation results. The main accordance of riser modulus is 1.2 times of the brake disk casting modulus, and the riser design adopted the modulus values near the main riser modulus to investigate the effects of riser on the casting. As the riser could not feed the casting successfully, the added chillers were designed to compensate the function and promote the riser's feeding through the directional solidification. Finally, the casting yield was optimized by the simulation of OptiCast module of the CAE software for the A390 aluminum alloy brake disk. The simulation results show that there exists similar shrinkage defects between the pressurized gating system with a gating ratio 1:2:1 and the unpressurized gating system with a gating ratio 1:2:2. On the riser modulus, the riser with a 10 modulus had adequate feeding distance for the casting, and it did not need a chiller design. But, there existed a short and inadequate feeding distance for the riser with a 8 modulus, and thus needed a chiller design to resolve the problem. As for the riser with a 6 modulus, it showed an impossible feeding result for the brake disk castings whether with a chiller design or not. Finally, the CAE simulation and the practical castings poured all reveal the chillers having a round disc shape design were better than the chillers with a rectangular shape on establishing the directional solidification for the casting .

Keywords : A390 Aluminum Alloy, Brake Disk, Computer-aided Engineering (CAE), Riser, Chiller, Modulus, Feeding

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