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Abstract:

Influence of carbide forming elements on the phenomenon of spontaneous disintegration of high-aluminum cast iron

The rapid development of technology in many branches of industry, such as energy, chemical and machine construction, and ever-increasing investor requirements mean that construction materials must meet increased operating parameters.

One of the most important alloying elements used in the production of castings resistant to the oxidizing atmosphere at high temperature is aluminum. Addition of aluminum to the cast iron on the specific contents of the other components makes it resistant to the high temperatures in different media, and a number of other valuable properties, e.g. increased abrasion resistance. In addition, the use of this material is also preferred because of the low manufacturing cost. They do not contain (or contain very small amounts) expensive alloying elements such as chromium, nickel or molybdenum. Despite many advantages, high aluminum cast iron has not found a wide application in the industry so far due to the difficulties encountered during machining and the occurrence of spontaneous disintegration.

Previous attempts to determine the causes of spontaneous disintegration by various researchers in many cases do not accurately describe them. In the work, based on the research, the mechanism of spontaneous disintegration of high-aluminum cast iron castings was defined, whose main reason was the large relative geometric dimension of Al_4C_3 carbide. In addition, methods for counteracting the phenomenon of spontaneous decay were developed. Tests carried out as part of the work showed that removal of Al_4C_3 carbides from the structure due to the introduction of high-aluminum cast iron elements that form carbides (eg Ti, W, V) affects the formation of TiC, WC, VC carbides in its structure. Thus, the disadvantageous separation of Al_4C_3 carbide is eliminated. In addition, the reduction of their size or shape change leads to the disappearance of the self-casting effect of high-aluminum cast iron casting, and the addition of B and Cr increases its plastic properties. Also, besides increasing the cooling speed, and an additional heat treatment performed in an appropriate manner change the shape of carbides preventing the phenomenon of spontaneous dissociation.