PHASE TRANSFORMATIONS IN PERITECTIC – TYPE STEELS

Description:
Peritectic reaction is one of the most widespread reactions in metal systems. The analysis of phase diagrams testifies that peritectic reaction is founded in more than 60% of binary alloys and almost in all trinary systems on the base of Fe, which include ferrite and austenite formers. After many years of experiments at Material science department of NMetAU the novel mechanism of peritectic reaction was discovered. The peritectic reaction is multistage process mainly consist of the following steps:
1. The first crystals of austenite nuclear on the border δ-ferrite/liquid and rapidly grow through this border forming thin irregular shell. The thin liquid interlayers are forming on the interface δ-ferrite/A. Liquid plays a great role in the mechanism of peritectic reaction being a transfer of alloying components.
2. The next stage of peritectic reaction is the growing of austenite grain. The mechanism of this stage depends from steel composition. So, in case of high alloying by ferrite-stabilizing elements the growing of austenite grain occur in the direction of δ-ferrite under the presence of constant quantity of liquid. Austenite grows in the condition of constant contact with melt (liquid).
In case of low containing of ferrite-stabilizing elements in steel or in steels alloyed by Ni and Mn (corrosion-resistant and heat-resistant steels) austenite grain grows both in the direction of δ-ferrite and initial melt. Peritectic reaction becomes multistage and structure of austenite becomes branched.

Innovative Aspect and Main Advantages:
The novel mechanism of peritectic reaction open a lot of ways of increasing steel's properties without significant funding investment.
– Steel making and casting: Using the proposed modes of steel making and casting it's possible to increase all quantity characteristics of steel structure. (The carbide grain significantly decreases. The average dimensions of eutectic colonies decrease simultaneously with their dispersity increasing.). The durability of tools made from steel which has been cast using proposed modes increases on 15% (comparing to ordinary steels).
– Electroslag remelting: The decreasing of electroslag remelting speed results in grainboundary eutectic percent-age decreasing with simultaneous homogeneity increasing along ingot section.
– Powder metallurgy.

Regulation of high-speed steels initial powder and taking into account their peritectic structure allows increasing steels compacting with simultaneous decreasing of carbide constituent dimensions. Also this regulation increases both steels heat-resistance and life time of tools.
– Welding.

Effect of peritectic shifted transformation during lazer welding process allows getting seamless structure of the weld. The main advantages are the following:
– Absence of alloying elements redistribution and excess phases in the area of welding joint;
– characteristics of welding join identical to initial metal;
– there is no need in heat-treatment operations.

Areas of Application:
– Steel making and casting;
– Electroslag remelting;
– Powder metallurgy;
– Welding.

Stage of Development:
Patented

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