Таблица 2. Эффективность влияния комплексных добавок на раннюю прочность бетона (температура твердения 30 градусов)

Добавка	Кол-во добавки, % массы цемента	Расход цемента, кг/м^3	Водо-цементное отношение	Жесткость, с	Предел прочности в возрасте 12 ч, МПа
Без добавок	-	470	0,35	5-7	24,2
САС	1,25	470	0,30	5-7	35,1
С-3	1,0	470	0,30	5-7	20,1

Внедрение беспропарочной и малопрогревной технологии производства железобетонных конструкций на основе применения комплексных добавок в настоящее время технически возможно и экономически оправдано. Кроме экономии ресурсов и снижения себестоимости достигается упрощение технологии и повышение качества и долговечности продукции.

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INDUCTION LOCALIZED PHYSICAL ACTION APPLIED TO A WORKPIECE'S TOOLED SURFACE AREA.

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Annotation

The objective of this article is to study an effective method of localized temperature impact through inductive heating of the outer layer of the workpiece's tooled surface area, which allows to control the break-up of the flow chips formed while tooling the workpiece.

1. Introduction

In the course of shaping a workpiece through cutting what happens in the area where the cutter meets the sheared layer of the workpiece is the plastic deformation and fracture of metal, which results in chips and its separation from the tooled metal block. Present-day production, when tooling workpieces of high-resistance steel in automated workcells, is often

faced with the trouble of breaking up and separating off the flow chips, which decreases the equipment operation efficiency.

One of the most effective ways to fully control the flow chips' break-up is to cause a preliminary localized plastic action applied to the exterior surface of the sheared layer in accordance with certain regulations. The particularity of lathe turning of workpieces exposed to such action lies in periodic alteration of cutting conditions compared to the original stock.

2. Experiment procedure

The authors suggest employing the induction technique of tooling a workpiece as the preliminary localized action method. Such method's advantages are: 1) generating heat directly within a metal by means of the induced current; 2) a possibility to concentrate a considerable amount of electric energy in a small volume of a heated metal which allows for high-speed heating; 3) provided with an engineered induction heater of a certain structure (see fig. 1) it allows for the heated area and depth of a required pattern ($h_m \times b_m$).

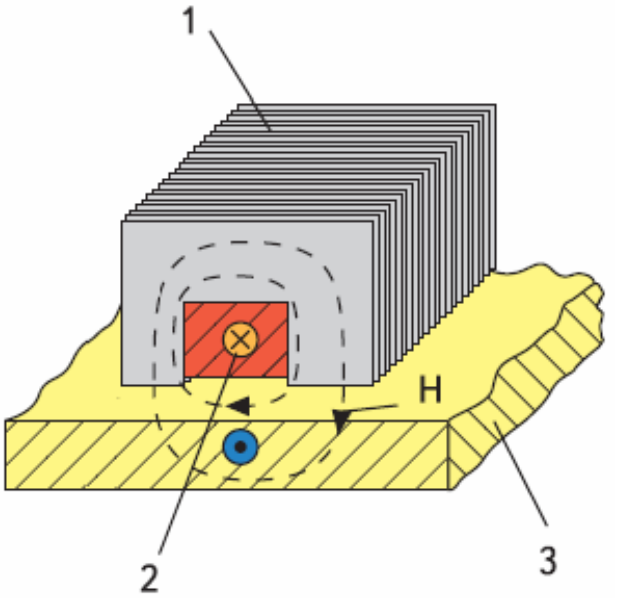

Fig. 1. Induction method of the localized induction action applied to the tooled surface area:
1 – magnetic circuit facilitating the current displacement in the required direction; 2 – inducing wire, creating a variable magnetic field; 3 – the tooled surface area of the workpiece.

The thermal impact on a workpiece in the area of the assumed allowance of the sheared layer according to a certain pattern leads to changes in the structure and physical properties of the processed metal. Altered is the density of crystal lattice defects which form high-energy configurations. When steel is heated its specific electrical resistance and magnetic conductivity vary as well.

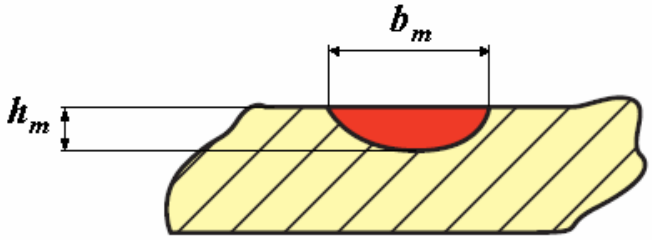

Fig. 2. The localized physical action area created with the application of the induction method.

Further, at the manual edge cutting stage, with a workpiece's rotary velocity n_m and inputting S_p the cutter bit intersects at point *C* with the localized physical action area on the cutting plane. (see fig. 3). The localized action area ($h_m \times b_m$) with a distorted crystal lattice (see fig. 2) and its physical properties different from that of the original material leads to instant changes of the strained and deformed state in the chip-forming area.

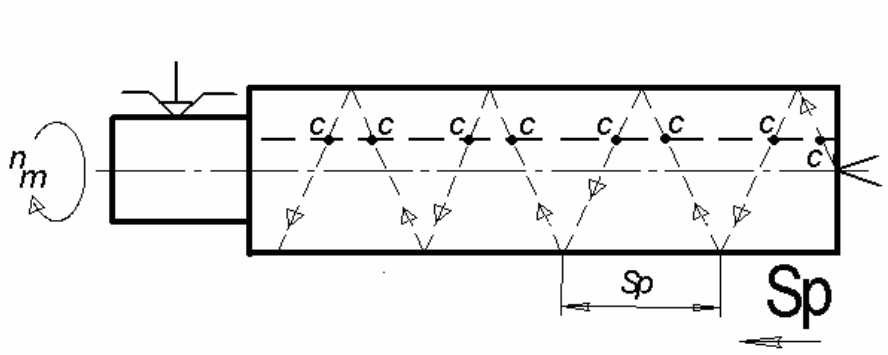

Fig. 3. Lathe turning process chart after creating the localized metastability area of the workpiece's surface through the application of the induction method.

3. Theoretical findings

The preliminary localized action area of the workpiece's surface causes internal structural variations. Heating the localized area of the steel workpiece to a temperature exceeding that of the phase transformation Ac_3 and its further cooling generate a high-hardness zone in the processed localized area *a* (see fig. 4).

As a result, the tempered zone structure *a*, heated above the critical point Ac_3, consists of martensite, and the transformation zone structure *в* is composed of martensite and ferrite. Deeper metal layers are heated to a temperature below the critical point Ac_1, hence they undergo no structure transformations. The layer *a*, heated above the critical point Ac_3, will be fully tempered, whereas the layer *в*, heated above the point Ac_1, but below the point Ac_3, will be under-tempered. Therefore the localized area structure will contain the tempered layer with a certain temperature and the transformation layer with incomplete tempering. Cessation of the thermal impact will entail temperature redistribution from the localized action area towards the core of the workpiece's stock material due to thermal conductivity. On account of the certain localized thermal impact the cooling of the heated area is done by the very bulk of the material which remains cold even after the source of heat has been terminated and acts as a coolant for localized heated surface layers.

The depth of the thermal impact zone when applying the induction heating technique is determined by the power of the induction heater and the duration of the heating. Consequently, the localized area depth of heat is a precisely controlled parameter in accordance with the imposed requirements.

At the further manual edge cutting stage the localized thermal impact area, while being in a metastable state compared to that of the stock metal, causes instant changes of the strained and deformed state in the chip-forming zone, allowing for chip segmentation process. Therefore if adhering to certain preliminary localized thermal impact specifications one may get chip segments of adequate length, which are determined by the executing mechanisms' effective and safe work conditions, its removal, transportation and recycling facilities.

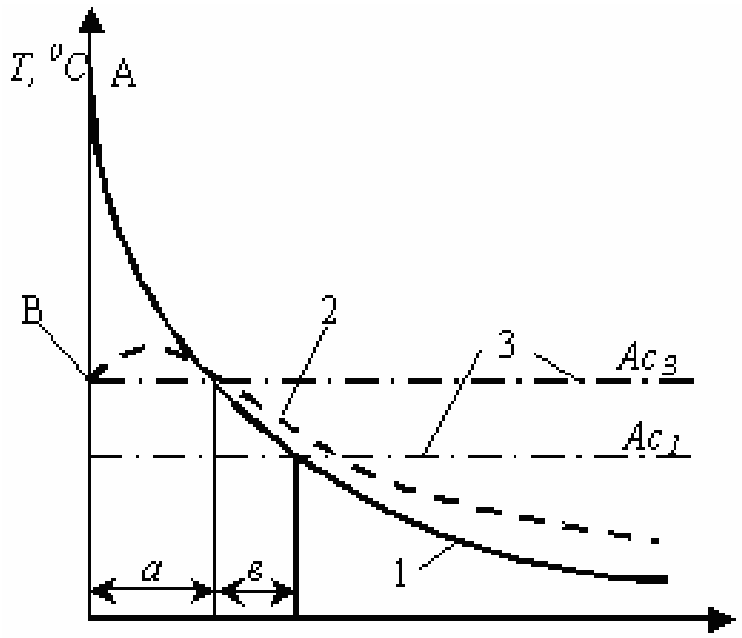

Fig. 4. Temperature variation in a sectional view of the localized thermal impact: 1 – when heating; 2 – in a given timeframe after cessation of the tooling; 3 – temperature lines of critical points Ac_1 and Ac_3.

4. Summary

1. The author present the induction method of preliminary heating of the processed material localized area whose application leads to increased structural metastability of the given localized area and which, at a further edge cutting stage, allows for flow chips breaking into segments of optimal length.

2. The advantages of the induction method of preliminary localized action have been described: heat generation within the metal itself, controlling the width and depth of heat, faster tooling of the workpiece.

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