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INVESTIGATION OF METAL REFINING DURING ELECTRIC ARC WELDING

Ermatov Ziyadulla Dosmatovich

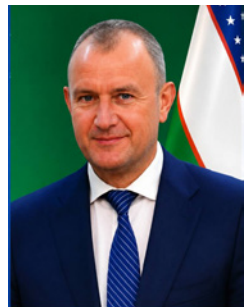
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Abstract. This study is dedicated to investigating the regularities of metal refining during electric arc welding. The paper analyzes the role of metallurgical processes in improving the quality and mechanical properties of the weld joint. Furthermore, it examines the oxidation-reduction and degassing reactions occurring in the molten pool, as well as their impact on reducing harmful impurities within the metal.

Keywords: electric arc welding, metal refining, metallurgical processes, weld seam, impurities, molten pool.

Аннотация. Настоящее исследование посвящено изучению закономерностей рафинирования металла при электродуговой сварке. В статье анализируется роль металлургических процессов в повышении качества и улучшении механических свойств сварного соединения. Кроме того, рассматриваются окислительно-восстановительные реакции и процессы дегазации, протекающие в сварочной ванне, а также их влияние на снижение содержания вредных примесей в металле.

Ключевые слова: электродуговая сварка, рафинирование металла, металлургические процессы, сварной шов, примеси, сварочная ванна.

INTRODUCTION

Refining weld metal involves removing harmful impurities—primarily sulfur and phosphorus in the case of steel. Sulfur impurities can adversely affect weld quality by increasing the susceptibility of the weld metal to hot cracking. This phenomenon is caused by the formation of iron sulfide, which has a melting point lower than that of steel. Furthermore, iron sulfide forms an even lower-melting eutectic with molten iron. Consequently, during the crystallization of the weld metal, these eutectic inclusions remain in a liquid state for an extended period, hindering the formation of bonds between the metal grains.

LITERATURE REVIEW

Effect of sulfur: The detrimental effects of sulfur impurities include the formation of hot cracks and red-shortness in the weld metal. Sulfur forms iron sulfides that remain liquid for an extended period during solidification, hindering the formation of bonds between grains. In alloy steels (especially those containing nickel), even lower-melting compounds may form. Carbon can also exacerbate the harmful effects of sulfur in unalloyed steels.

Effect of phosphorus: The presence of phosphorus increases the susceptibility of the weld metal to hot cracking. Phosphorus not only forms low-melting iron phosphides and eutectics but also dissolves in the iron. Its solubility in austenite is lower than in ferrite, which increases the risk of hot cracking when welding high-alloy steels. Carbon and low-alloy steels are less sensitive to typical phosphorus concentrations.

Non-metallic inclusions: The presence of non-metallic inclusions impairs low-temperature toughness and increases susceptibility to brittle fracture. Stresses concentrate around these inclusions, creating zones of localized plastic deformation. The level of inclusion contamination is a critical factor.

RESEARCH METHODOLOGY

To improve weld quality, sulfur content should be minimized within the applicable material and process requirements. To this end, sulfur levels are restricted in all welding electrode components as well as in the base metal. During the welding process itself, a special refining treatment is applied to the melt, which involves transferring sulfur into the slag in the form of compounds insoluble in the base metal [3].

The extent to which segregating sulfur and phosphorus impurities detrimentally affect the low-temperature brittleness of the weld metal depends primarily not on their total content, but rather on the degree of phosphorus segregation within the weld metal's grain structure and on the size, shape, and distribution of sulfide inclusions [1].

Various methods for removing sulfur from molten iron have been analyzed based on thermodynamic calculations [2]. The analysis indicates that slags with high sulfide capacity can effectively promote sulfur removal from molten metal. Studies on the kinetics of sulfur transfer from metal to slag have demonstrated that welding conditions can be established to enable deep desulfurization of the metal, even within a short timeframe comparable to the lifespan of the weld pool.

The presence of phosphorus impurities in electrode coatings has an effect similar to that of sulfur—namely, it increases the susceptibility of the deposited metal to hot cracking. Unlike sulfur, phosphorus not only forms low-melting iron phosphides (Fe_2P , Fe_3P) and phosphide eutectics but also dissolves in iron, potentially remaining in the weld metal in a dissolved state [6]. The presence of such inclusions can increase the susceptibility of the weld metal to hot cracking. The likelihood of cracking increases with higher phosphorus concentrations and lower phosphorus solubility in the metal. For instance, the solubility of phosphorus in the austenite crystal lattice is lower than in the ferrite lattice, which increases the risk of hot cracking when welding high-alloy steels [4]. Phosphorus concentration is controlled by imposing strict specifications on the phosphorus content of welding material components and by binding the element into slag-forming complex compounds during the welding process.

It should also be noted that specifications regarding phosphorus content are less stringent for the welding of carbon and low-alloy steels, as typical phosphorus concentrations in these steels are generally associated with a lower susceptibility to hot cracking [1].

ANALYSIS AND RESULTS

Metal refining—the removal of harmful impurities—is a crucial metallurgical operation; for iron-based alloys, this specifically involves removing sulfur and phosphorus [5].

Sources of sulfur and phosphorus entering the metal during welding include:

- a) the molten base metal and filler metal;
- b) slags (fluxes, coatings).

Sulfur is a harmful impurity that causes hot shortness in steels and significantly increases their susceptibility to hot cracking during casting and welding.

This effect of sulfur on metal properties at high temperatures stems from its tendency to form compounds with iron and low-melting eutectics; these weaken the bonds between individual crystallites (grains) across a wide temperature range. For instance, iron sulfide (FeS) has a melting point of 1195°C , while the eutectic formed by this sulfide and iron melts at 985°C . The $2\text{FeO} \cdot \text{SiO}_2 + \text{FeS}$ eutectic also has a low melting point.

The higher the sulfur content in the metal, the greater the formation of low-melting eutectics and the more pronounced the steel's hot shortness. Consequently, sulfur content is typically restricted to levels permissible for steel in general and for weld metal in particular.

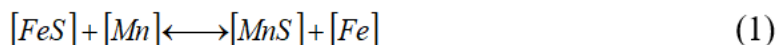
The presence of sulfur in alloy steels—particularly those with high nickel content—can increase susceptibility to hot cracking through the formation of low-melting sulfide-containing phases. Other elements can also exacerbate

the harmful effects of sulfur; in the case of unalloyed steels, for instance, carbon plays this role.

Consequently, to improve the properties of the steel and the weld metal, the aim is to reduce the sulfur content to the lowest permissible level. To achieve this, upper limits are placed on sulfur content—primarily in filler metals and electrode coatings—during welding. Furthermore, various methods are employed to transfer sulfur from the metal into the slag or to bind it into compounds that do not form low-melting constituents within the metal. When welding steels, the following approaches are used:

a) binding sulfur into manganese sulfide (MnS, melting point 1610°C);

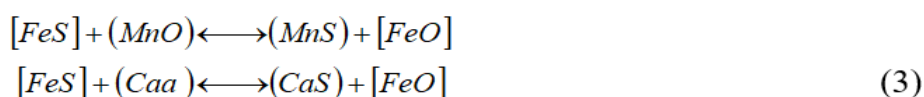
b) removing sulfur into the slag through the action of MnO and CaO. The binding of sulfur into MnS occurs according to the reaction:



with an equilibrium constant:

$$K = \frac{[MnS] \cdot [Fe]}{[FeS] \cdot [Mn]} \quad (2)$$

The concentration of FeS in the metal decreases as the Mn concentration increases. However, the reaction binding sulfur into MnS proceeds only as the metal temperature drops—a stage when reactions generally occur more sluggishly. Consequently, even with a substantial amount of Mn present in the metal, a significant portion of the sulfur may remain bound as FeS. Reducing the FeS content in the molten metal is achieved through the action of slags containing MnO and CaO:



A reduction in the FeS concentration in the metal is promoted by a higher degree of metal deoxidation (lower [FeO] content) and increased MnO and CaO levels in the slag. Consequently, basic slags are more favorable for reducing the sulfur concentration in the metal.

In some cases, desulfurization is aided by binding sulfur into volatile compounds (such as Al₂S₃, with boiling points of 1550°C and 940°C, respectively).

Phosphorus is also a highly detrimental impurity in iron alloys. It impairs the mechanical properties of steels, causing cold shortness in low-alloy and carbon steels and increasing the susceptibility to hot cracking in austenitic steels.

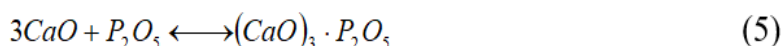
Reducing the phosphorus content in the weld metal is achieved by limiting its concentration in the base metal, filler metal, coatings, fluxes/slags, and the gas phase interacting with the metal.

The removal of phosphorus from the metal is based on its oxidation and the binding of phosphorus pentoxide into complex compounds that enter the slag. The oxidation of phosphorus—which forms the phosphides Fe₂P and Fe₃P with iron—proceeds according to the reactions [5]:



The acidic oxide P₂O₅ forms complex compounds with basic oxides. Arranged in order of increasing affinity for it, the basic oxides form the following series: FeO, MnO, MgO, CaO.

The binding of phosphorus pentoxide proceeds most actively through the following reactions:



The binding of P₂O₅ by MnO proceeds less actively. A reduction in the phosphorus content of the metal is facilitated by increasing the content of free FeO and CaO in the slag and decreasing the amount of CaO bound to P₂O₅.

In acidic slags, FeO and CaO become bound in complex compounds with SiO₂ and TiO₂; consequently, their free concentrations are lower, making the removal of phosphorus from the metal into the slag more difficult. Basic

slags are more favorable for dephosphorization processes. In basic slags, the concentration of $\text{Ca}_3\text{P}_2\text{O}_8$ is reduced by diluting the slag with appropriate neutral additives, typically fluorspar. Such an additive is frequently used to improve various physical properties of the slag—specifically by increasing its fluidity—thereby enabling a larger relative volume of the slag to participate in reactions with the metal [4].

The process of dephosphorizing the metal via slag treatment proceeds more actively at lower temperatures.

Reactions between P_2O_5 and MnO are similar in nature but have a lesser impact on the dephosphorization process. It should be noted that phosphorus is an impurity associated with manganese; consequently, an increase in manganese compounds within coatings and fluxes leads to a rise in phosphorus content in the slag and, by extension, in the metal itself.

The presence of a significant quantity of non-metallic inclusions in the weld metal adversely affects the mechanical and technological properties of welded joints, particularly regarding cold resistance and the weld metal's susceptibility to brittle fracture. Stress concentrations occur in the vicinity of non-metallic inclusions, resulting in the formation of zones of localized plastic deformation. As the total number of such inclusions increases, so does the number of simultaneously initiating cracks, facilitating their coalescence.

The role played by non-metallic inclusions differs between ductile and brittle fracture processes. The influence of inclusions on ductile fracture in weld metal manifests through the mechanism of microvoid formation and coalescence. The stress state surrounding the inclusions is exacerbated by existing thermal stresses within the metal. Brittle fractures are associated with the presence of internal defects of critical size. The level of non-metallic inclusion contamination is an important factor influencing the metal's resistance to brittle fracture.

The low-temperature toughness of the weld metal is supported when, at the service temperature of the welded structures, failure occurs via a ductile mechanism—that is, through the growth and coalescence of voids nucleating at non-metallic inclusions. The greater the spacing between non-metallic inclusions, the more energy-intensive the process of crack formation in the weld metal becomes.

The effects of sulfur and phosphorus on hot cracking reinforce each other, as the segregation zones of compounds containing these elements coincide within the weld metal. Achieving low sulfur content in the flux and deposited metal is easier than achieving low phosphorus content, because sulfur oxidizes and its concentration decreases during the smelting and welding processes. Reducing the phosphorus content in the flux and deposited metal can be technically challenging under welding conditions; therefore, the use of high-purity flux is important for achieving favorable weld performance characteristics.

The morphology of non-metallic inclusions significantly influences the fracture resistance of the weld metal. For instance, unlike brittle, angular inclusions, ductile and readily deformable inclusions of a rounded shape possess a coefficient of linear thermal expansion and a Young's modulus that do not differ significantly from those of the metal itself; this results in lower thermal stresses within the weld metal.

Process kinetics and thermodynamics: The analysis indicates that appropriately selected welding conditions can facilitate substantial desulfurization of the metal, even within the brief lifespan of the weld pool. The reaction proceeds more efficiently at lower temperatures. A reduction in metal sulfur content is promoted by a higher degree of deoxidation and increased sulfur content in the slag.

Role of inclusion morphology: Fracture resistance is significantly influenced by the morphology of non-metallic inclusions. Ductile, readily deformable, and rounded inclusions possess a coefficient of linear expansion and a modulus of elasticity close to those of the metal; this can help reduce internal thermal stresses compared with brittle, angular inclusions.

Interplay of elements: The effects of sulfur and phosphorus on hot cracking reinforce each other due to the coincidence of their segregation zones. Achieving low sulfur content can be comparatively easier under suitable refining conditions, whereas reducing phosphorus levels in the flux and weld metal may be more challenging. Therefore, the use of high-purity fluxes can contribute to improving weld quality.

CONCLUSIONS AND RECOMMENDATIONS

Weld quality depends critically on minimizing harmful impurities (sulfur and phosphorus), preventing the formation of low-melting eutectics, and controlling the quantity and morphology of non-metallic inclusions. The primary methods for metal purification are limiting impurities in the raw materials and effective refining via the slag phase.

Strictly limit the maximum sulfur and phosphorus content in welding consumables, electrode coatings, and fluxes.

Use basic slags to effectively bind sulfur and remove phosphorus while maintaining the required level of metal deoxidation.

Employ neutral additives (e.g., fluorspar) to regulate slag fluidity and enhance interaction with the weld pool.

Control the morphology of non-metallic inclusions, avoiding the formation of brittle, sharp-angled structures

in favor of rounded, ductile forms to improve low-temperature toughness and resistance to hot cracking.

References

1. Boronenkov V. N., Salamatov A. M. Computational assessment of the interaction kinetics of multicomponent metal and slag during submerged arc welding // *Avtomaticheskaya Svarka*. – 1985. – No. 8. – P. 19–23.
2. Dunyashin N. S. Development of a multicomponent electrode coating for manual arc welding of low-carbon and low-alloy steels. – Tashkent: Fan va texnologiya, 2019. – 160 p.
3. Ermatov Z. D. Development of scientific principles for creating multicomponent electrode coatings for manual arc surfacing: monograph. – Tashkent: Fan va texnologiya, 2021. – 140 p.
4. Khudoyorov S. S., Galperin L. V., Dunyashin N. S., Ermatov Z. D., Saidakhmatov S. A., Abdurakhmonov M. M. Study interaction of molten metal and slag in arc welding // *International Journal of Advanced Research in Science, Engineering and Technology*. – 2022. – Vol. 9, No. 9. – P. 19771–19775. – URL: <https://www.ijarset.com/upload/2022/september/12-xudoyorov-28.pdf>
5. Kou S. *Welding Metallurgy*. – 3rd ed. – John Wiley & Sons, 2020. – 688 p. – ISBN 978-1-119-52481-6. – URL: <https://www.wiley-vch.de/en/areas-interest/engineering/materials-science-10ms/metals-alloys-10ms1/joining-welding-and-adhesion-10ms12/welding-metallurgy-978-1-119-52481-6>
6. Verkhoturov A. D., Babenko E. G., Makienko V. M. *Methodology for creating welding materials: monograph* / ed. by B. A. Voronov. – Khabarovsk: FESTU Publishing House, 2009. – 125, [1] p.

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