STUDY OF THE EFFECT OF SUN AND LIQUID ON THE HARDNESS OF CHEMICALLY HEATED NICKEL COATING.

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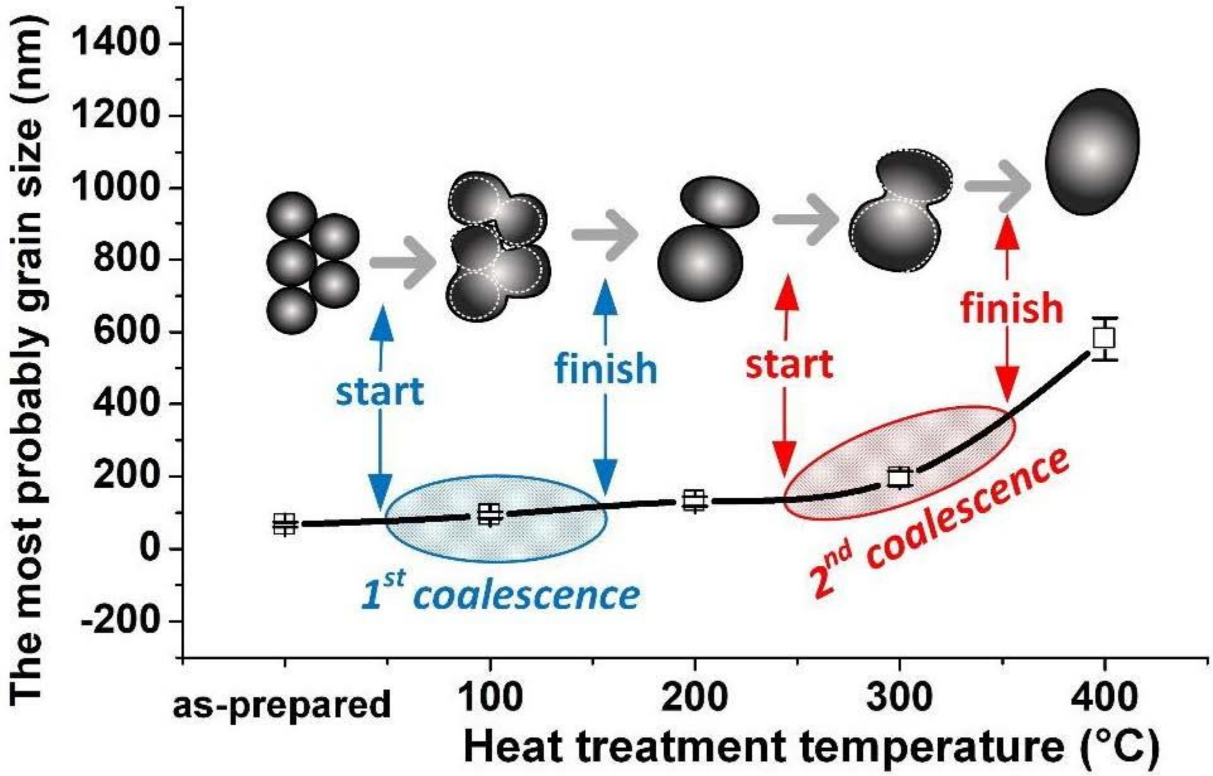
Annotation: These studies aim to investigate and analyze the effect of heat treatment on the phase transformation of a thin nickel layer on a steel sheet substrate.

Key words: heat, chemical elements, nickel, steel, solution, substrate, electroless coating, hardness.

The equipment components used in almost all industrial companies are usually steel materials. Many components experience surface friction during use, leading to component corrosion Material corrosion, especially steel, shortens the service life of a component. In addition, steel components are prone to corrosion. Therefore, we need anti-corrosion and corrosion protection for steel parts. Surface engineering technology, or surface engineering, is commonly used in industry to optimize the performance of equipment. Surface engineering aims to increase the hardness and corrosion resistance of components that rub against each other and to produce durable components for industrial test instruments and equipment.

One of the methods used is electroplating, however, the electroplating method is prone to hydrogen porosity, and it is difficult to produce uniform layers, especially at the edge of the sample. Electroless nickel plating (ENP) is an electroless nickel plating process on the surface of a substrate. Electroless nickel is an alternative method for preventing hydrogen hypophosphite. In addition, it forms a layer of uniform thickness and good corrosion resistance. The application of electroless nickel is limited by the size of the component to be coated. In order to obtain the maximum hardness value, studies were conducted on the effect of parameters on electroless nickel. These parameters include solution composition, solution temperature, pH, and time.

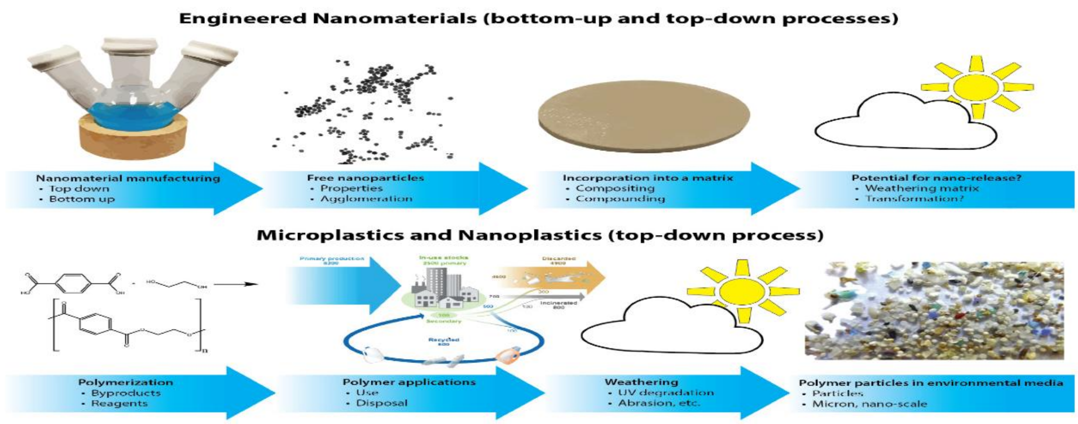


After performing electroless nickel, heat treatment is also performed to increase the hardness of the coating. During heat treatment, temperature and time affect the final hardness of the layer.

XRD characterization of electroless nickel deposits did not show the presence of Ni and Ni-P compounds. After heat treatment, crystalline Ni and Ni3P appear in the XRD results. NisP compounds appear after heating at a temperature of 400 ° C. Therefore, it is necessary to study some parameters affecting the mechanism of hardness increase.

In this study, the phase formed in the layer was analyzed to determine the cause of the hardness increase in the ENP layer after heat treatment. In general, a surface layer is coated before the workpiece is used in various ways to obtain the desired properties. A coating is a surface layer that originates from a material different from the material being coated (the substrate). The present study used an electroless plating method to deposit nickel on a steel plate. Electroless plating is a coating method through chemical reactions without the need for electricity. Electroless Nickel Plating (ENP) is one of the commonly used plating methods, which uses nickel as the plating material.

The phenomenon of nickel precipitation from the reflux of a salt solution was discovered by Waltz in 1844. Electroless nickel plating is widely used because it has several advantages. The nickel layer produced by ENP is generally the same on the entire substrate surface, both external and internal, and can be used to cover a workpiece with complex shapes. In addition, ENP is a good choice for coating because of the corrosion resistance resulting from the uniform coating layer, resulting in a good coating for the substrate surface. The electroless nickel method is more efficient because it does not require complex equipment and the final result is better without the finishing process.



Samples are made of low-carbon steel plates with a length of 30 mm, a width of 15 mm and a thickness of 0.5 mm. The surface to be covered is first polished and polished until smooth. Then, the surface is washed and washed with an acetone solution. After mixing the solution bath 1 used for coating, the active ingredients are mixed with the composition as in table 1. The chemical solution is a mixture of several chemical compounds that have their own functions in electroless nickel. The used solution contains nickel source, reducing agent, complexing agent, inhibitor and buffering agents.

The coating process and testing were carried out by soaking the steel plate for 100 minutes per day. With the addition of sodium hydroxide, the process is kept constant at pH 7.5 as well as temperature. Layers are formed due to autocatalytic reactions. Implementation of nickel ion incorporation through hypophos phite compounds. The initial precipitate becomes a catalyst for the reduction reaction. A chemical reaction will have occurred.

1-After coating, the sample is heat treated in a furnace with a temperature of 320 °C and a holding time of 340 °C for 30 minutes. The hardness test was performed using the micro Vickers method with a load of 0.05 kg. In order to determine the effect of heat treatment on the structure of the formed nickel layer, X-ray diffraction (XRD) characterization was conducted. Coating layer quality monitoring and thickness measurements are performed by metallographic method. The table below contains the compounds mentioned in the process of sample preparation.

1- Table

Compounds	**Chemical formulas**	Qty . (g / L)	Phase
Nickel chloride	$NiCl_2\ 6H_2O$	45	Hard
Sodium hypophosphite	$NaH_2PO_2 . H_2O$	11	Hard
Ammonium chloride	NH4Cl	50	Hard
Sodium citrate	$C_6H_5Na_3O_7 \cdot 2H_2O$	=100	Hard
Sodium hydroxide	NaOH	= pH 7,5	Liquid

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