Determination of the penetration hardness and analysis of stainless steel alloys by means of Laser Induced Breakdown Spectroscopy (LIBS)

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Abstract
A significant feature of alloys is their surfaces hardness which its measurement by common mechanical techniques is always accompanied by challenges. In this investigation, we used Laser Induced Breakdown Spectroscopy (LIBS) as a replacement method for common mechanical techniques employed for the surfaces hardness measurement of different alloys. After recording the spectrum of alloy samples, K-Nearest Neighbors (KNN) method was used in order to identify the surface hardness of analyzed sample. The obtained results showed that the LIBS-KNN method can distinguish and identify the surfaces hardness of samples with 93.3% accuracy. In addition, in order to identify the percentage of constituent elements of alloys and their hardness, calibration approach was applied showing that there is an appropriate linear relation between recorded emission lines from the LIB spectra of sample alloys and the percentage of their constituent elements as well as their Vickers hardness numbers. Therefore, considering the exclusive advantages of LIBS technique, its high speed analysis, its non-destructive analysis and being portable, some of the current difficulties in conventional mechanical techniques can be removed.

Keywords: Laser Induced Breakdown Spectroscopy (LIBS), penetration hardness, alloys

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