World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:13, No:10, 2019

Failure Analysis of Low Relaxation Prestressed High Carbon Steel Wire During Drawing Operation: A Metallurgical Investigation

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Abstract : Wires breakages during cold drawing are a complex phenomenon; wire breakages may be induced by improper wire-rod quality, inappropriate heat-treated microstructure, and/or lubrication breakdown on the wire surface. A comprehensive metallurgical investigation of failed/broken wire samples is therefore essential for understanding the origin of failure. Frequent breakage of wires during drawing is a matter of serious concern to the wire drawers as it erodes their already slim margins through reduced productivity and loss in yield. The present paper highlights the failure investigation of wires of Low Relaxation Prestressed High Carbon grade during cold drawing due to entrapment of hard constituents detached from the roller entry guide during rolling operations. The hardness measurement of this entrapped location indicates 54.9 Rockwell Hardness as against the rest portion 33.4 Rockwell Hardness. The microstructure chemical analysis and X-ray mapping analysis data of the entrapment location confirmed complex chromium carbide originated from D2-steel used in entry guide during the rolling process. Since the harder entrapped phase could not be deformed in the same manner as the parent phase, the failure of the wire rod occurs during hot rolling.

Keywords : LRPC, D2-steel, chromium carbide, roller guide
Conference Title : ICEFA 2019 : International Conference on Engineering Failure Analysis
Conference Location : Paris, France
Conference Dates : October 29-30, 2019