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Metallurgical investigation of breakage of automotive spring washer during twist test

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A washer is a thin plate with a hole that is normally used to distribute the load of a threaded fastener, such as a screw or nut. The washer used in automotive engine component is of split or spring lock washer. A ring split at one point and bent into helical shape. The benefit of spring lock washers lies in the trapezoidal shape of the washer. When compressed to loads near proof strength of the bolt, it will twist and flatten. This reduces the spring rate of the bolted joint which allows it to maintain more force under the same vibration levels. This prevents from loosening. The steel washer is one of the critical safety component for automobile engine component and its failure may cause severe safety issue. Before manufacturing, the washer undergoes different stages of rolling and heating process. After manufacturing of washer toughness test is done to find out the metallurgical soundness and surface quality of the washer. The present paper highlights premature failure of washer which failed during twist test. From the analysis, it has been observed that the distribution of spheroidized carbide is more uniform in good spring washer samples than that of rejected samples. Hardness profile variation observed between good and bad samples. Overall investigation does not indicate any problem related to supplied wire rod material quality as no wire breakage problem observed till flat rolling stage. Inhomogeneous annealed structure in flat wire seems to be resulted into variation in washer performance during twist testing.

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