

The Effect of Surface Roughness on the Fatigue Life of SCM440 Steel

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Abstract : The purpose of the present study is to analyze the effect of surface roughness on fatigue life of SCM440 steel. Two groups of specimens were made from SCM440 steel with and without surface polished after forging process and resulted in different values of surface roughness. The difference of the surface roughness between two groups was clearly distinguished even to the naked eye. Surface roughness of both groups of the specimens was quantitatively measured by a roughness measuring device, Talysurf series2 (Taylor-Hobson Co., USA). Average roughness (Ra) and maximum roughness depth (Rmax) values were obtained by scanning 45 mm with a speed of 0.25 mm/s. Fatigue tests were conducted using a three-point bending method with a cyclic sinusoidal profile of 5 Hz, stress ratio of $R = 0.1$ and reference life for fatigue limit of 1×10^6 cycles. Ra and Rmax without surface polished were $10.497 \pm 1.721 \mu\text{m}$ and $87.936 \pm 16.210 \mu\text{m}$, respectively while those values with surface polished were much smaller (ongoing measurements). Fatigue lives of the surface-polished specimens achieved approximately 1×10^6 cycles under the maximum stress of 900 MPa, which was 10 times longer than those of the surface-untreated specimens with an average roughness of $10.082 \mu\text{m}$. The results showed that an increase in surface roughness values led to a decrease in fatigue lives.

Keywords : surface roughness, fatigue test, fatigue life, SCM440 steel

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