Titanium alloys are known for their high strength, rigidity with low density, and exceptional biocompatibility, thus play an important role in aerospace, biomedical and automotive industries. However, they have a poor machinability due to low thermal conductivity and low elastic modulus. In this paper, the use of magnetic field assisted diamond turning (MFDT) to improve thermal conductivity and thereby increase the machinability of Ti-6Al-4 V alloys. The results suggests that the continuous and narrow chips are formed in applying the magnetic field, while under non-magnetic field conditions, the chips present discontinuous morphology and cracks. In addition, under the non-magnetic field condition, the roughness of the workpiece surface shows a concentration phenomenon, while after applying the magnetic field, the roughness of the workpiece surface presents a uniform distribution. Finally, there is a small difference between the microhardness values of the workpiece surface with and without magnetic field, and the microhardness values of the workpiece surface from the edge to the centre show a stable trend under the magnetic field condition, while it fluctuates greatly under the non-magnetic field condition.