

عنوان مقاله:

Study of Effect of Cooling/Lubricating Fluids, Machining Parameters, and Rock Mechanical Properties on Penetration Rate in Rock Drilling Process

محل انتشار:

مجله معدن و محیط زیست, دوره 12, شماره 3 (سال: 1400)

تعداد صفحات اصل مقاله: 19

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خلاصه مقاله:

In most rock drilling operations, the low rate of penetration (ROP) can be primarily attributed to the presence of the cuttings produced during drilling and the thermal stresses caused by friction at the bit-rock interface, which can be exacerbated with the increasing strength, hardness, and abrasivity of the drilled rock. In order to improve ROP, drill bit lifetime, and cutting power, it is necessary to minimize the process forces due to the mechanical bit-rock interaction and the thermal stresses generated in the drill hole. Any improvement in these areas is extremely important from both the technical and the economic perspectives. This improvement can be achieved by the use of appropriate cooling/lubricating fluids in the drilling process in order to increase ROP, reduce the temperature of the drilling environment, and create a clean drill hole free of cuttings. In this work, a series of laboratory drilling tests are performed to investigate and compare ROP in the drilling of seven samples of hard and soft rock in the presence of six different cooling-lubricating fluids. The drilling tests are performed on the cubic specimens with a laboratory-scale drilling rig at several different rotation speeds and thrust forces. The statistical analyses are performed in order to investigate the relationship between ROP and the mechanical properties of the rock, properties of the fluid, and machining parameters of the drilling rig. These analyses show that under similar conditions in terms of mechanical properties of the rock using Syncool with a concentration of 1:100 and soap water with a concentration of 1:120 instead of pure water leads to the average 31% and 37% increased ROP in granite, 36% and 43% increased ROP in marble, and 47% and 61% increased ROP in travertine, respectively. These results demonstrate the good performance of these cooling/lubricating fluids in increasing ROP.

کلمات کلیدی:

Drilling, rate of penetration, coolant-lubricant fluids, Statistical Analysis, linear univariate

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