Abstract Submitted
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Shockwave and Plasma Accelerated Rock Cracking (SPARC) for hard rock drilling[1] MIRZA AKHTER, JACOB MALLAMS, XIN TANG, AAMER KAZI, YI-TANG KAO, SANAT KUMAR, BRUCE TAI, DION ANTAO, ALAN PALAZOLLO, DAVID STAACK, Texas A&M University — Shockwaves produced by underwater plasmas have the ability to induce cracks in rocks. Underwater plasma spark (nanosecond pulsed) initiates a cavitation bubble similar to a snapping shrimp's burrowing activity. The cavitation event is accompanied with intense shockwaves capable of cracking rock surface. This reduces the integrity of the rock which makes it easier to drill and potentially increases drilling rate of penetration. The effect of low energy (˜80J) nanosecond plasma pulses on crack extension and cutting energy reduction in granite rock was studied. A 56% reduction in cutting energy was observed with cracks extending up to 0.3 inches in length. Nanosecond plasma pulsing was also carried out at downhole pressure conditions (5000 psi) and its effect on rock cracking was studied. This work also presents the incorporation of SPARC plasma technology in traditional drill bits. SPARC-drill bits were tested in an in-house fabricated ambient pressure laboratory drill rig that uses a rotating air spark switch to produce nanosecond plasma pulses. The observed reduction in cutting energy due to SPARC show that it may be useful in aiding the traditional drilling method, thereby reducing drilling operational time.

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