

Design of a self-adaptive bionic PDC bit for soft-hard interbedded strata

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Cats protract claws while hunting or pawing on the ground, and retract to muscles when relaxing. Inspired by this behavior, and in order to solve the problem of short service life and low comprehensive drilling efficiency of PDC bits which results from its poor adaptability to soft-hard interbedded strata, a self-adaptive bionic PDC bit was designed which can use the elastic element to adjust its back-rake angle according to the formation hardness to improve the adaptability of PDC bits. Theoretical analysis and drilling test results show that the self-adaptive bionic PDC bit has a strong adaptability to soft-hard interbedded rock strata. When drilling in soft rock, the back-rake angle is small and the ROP (rate of penetration) is high; when drilling in hard rock, the angle becomes larger to reduce the abnormal damage of cutters. Thus, it can improve the integrated drilling efficiency and service life of PDC bits. In the whole drilling test, the average penetration rate of the self-adaptive bionic PDC bit increases by 10 to 13 % over conventional PDC bits with the same dimension and material.

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