Appendix

Table A1

Peak strength of samples containing a single flaw.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material | *σ*i  (MPa) | *σ*c (MPa) | | | | | | | *σ*c/*σ*i | | | | | | | Source |
| 0° | 15° | 30° | 45° | 60° | 75° | 90° | 0° | 15° | 30° | 45° | 60° | 75° | 90° |
| Rock-like material | 47.29 |  | 35.45 | 36.29 | 38.9 | 43.32 | 45 |  |  | 0.75 | 0.77 | 0.82 | 0.92 | 0.95 |  | Zhuang et al. (2014) |
| Rock-like material | 27.21 | 16.89 | 15.59 | 18.25 | 19.34 | 21.65 | 25.65 | 26.94 | 0.62 | 0.57 | 0.67 | 0.71 | 0.80 | 0.94 | 0.99 | Jin et al. (2017) |
| Rock-like material | 27.21 | 16.61 | 14.25 | 16.58 | 18.71 | 19.59 | 23.57 | 25.29 | 0.61 | 0.52 | 0.61 | 0.69 | 0.72 | 0.87 | 0.93 | Jin et al. (2017) |
| Sandstone | ~50 | 20.14 | 21.85 | 25.37 | 29.84 | 35.48 | 41.01 | 48.13 | 0.4 | 0.44 | 0.51 | 0.6 | 0.71 | 0.82 | 0.96 | Miao et al. (2018) |
| Sandstone | 212.08 |  | 139.28 |  | 115.17 | 149.96 | 181.71 |  |  | 0.86 |  | 0.54 | 0.71 | 0.86 |  | Yang and Jing (2011) |
| Sandstone | ~72.3 |  | 42.96 | 44.11 | 50.21 | 61.48 | 67.78 |  |  | 0.59 | 0.61 | 0.69 | 0.85 | 0.94 |  | Zhu et al. (2016) |
| Sandstone | 77.91 |  | 58.02 | 59.66 | 60.78 | 63.84 | 67.33 |  |  | 0.74 | 0.77 | 0.78 | 0.82 | 0.86 |  | Li et al. (2019b) |
| Granite | 171.83 | 116.2 | 115.64 | 120.69 | 130.15 | 143.08 | 152.26 | 165.1 | 0.68 | 0.67 | 0.7 | 0.76 | 0.83 | 0.89 | 0.96 | Yang et al. (2019) |
| Granite | 171.83 |  | 106.74 | 129.2 | 132.29 |  | 162.33 | 157.3 |  | 0.62 | 0.75 | 0.77 |  | 0.94 | 0.92 | Yang et al. (2019) |
| Gypsum | 47.4 |  | 29.34 | 23.68 | 30.2 | 22.37 | 30.93 |  |  | 0.62 | 0.5 | 0.64 | 0.47 | 0.65 |  | Zhao et al. (2019) |
| Coal | 14.5 | 8.06 | 9.02 | 9.52 | 10.06 | 10.54 | 11.16 | 13.61 | 0.56 | 0.62 | 0.66 | 0.69 | 0.73 | 0.77 | 0.94 | Li et al. (2019a) |

Note: *σi* is the peak strength of intact samples, *σc* is the peak strength of pre-cracked samples, the symbol “~” means the datum was obtained from figures.

Table A2

Elastic modulus of samples containing a single flaw.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material | *E*i  (GPa) | *E*c (GPa) | | | | | | | *E*c/*E*i | | | | | | | Source |
| 0° | 15° | 30° | 45° | 60° | 75° | 90° | 0° | 15° | 30° | 45° | 60° | 75° | 90° |
| Sandstone | 35.95 |  | 32.86 |  | 28.11 | 32.25 | 33.97 |  |  | 0.91 |  | 0.78 | 0.9 | 0.94 |  | Yang and Jing (2011) |
| Sandstone | ~13.47 |  | 8.77 | 9.07 | 10.39 | 11.11 | 12.16 |  |  | 0.65 | 0.67 | 0.77 | 0.82 | 0.9 |  | Zhu et al. (2016) |
| Sandstone | 8.85 |  | 7.61 | 7.44 | 7.49 | 7.74 | 7.78 |  |  | 0.86 | 0.84 | 0.85 | 0.87 | 0.88 |  | Li et al. (2019b) |
| Granite | 44.94 | 31.78 | 29.61 | 35.26 | 32.74 | 41.02 | 42.02 | 41.83 | 0.71 | 0.66 | 0.78 | 0.73 | 0.91 | 0.94 | 0.93 | Yang et al. (2019) |
| Granite | 44.94 |  | 30.15 | 37.22 | 35.77 |  | 41.08 | 42.37 |  | 0.67 | 0.83 | 0.8 |  | 0.91 | 0.94 | Yang et al. (2019) |

Note: *E*i is the elastic modulus of intact samples, *E*c is the elastic modulus of pre-cracked samples.

Table A3

Peak strain of samples containing a single flaw.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material | *ε*i (%) | *ε*c (%) | | | | | | | *ε*c/*ε*i | | | | | | | Source |
| 0° | 15° | 30° | 45° | 60° | 75° | 90° | 0° | 15° | 30° | 45° | 60° | 75° | 90° |
| Sandstone | 1.17 |  | 1.02 | 1.07 | 1.05 | 1.01 | 1.08 |  |  | 0.87 | 0.91 | 0.9 | 0.86 | 0.92 |  | Li et al. (2019b) |
| Sandstone | 0.75 |  | 0.57 |  | 0.48 | 0.59 | 0.63 |  |  | 0.76 |  | 0.64 | 0.79 | 0.84 |  | Yang and Jing (2011) |
| Sandstone | 0.72 |  | 0.62 | 0.63 | 0.63 | 0.7 | 0.74 |  |  | 0.86 | 0.88 | 0.87 | 0.97 | 1.03 |  | Zhu et al. (2016) |
| Granite | 0.61 | 0.48 | 0.55 | 0.48 | 0.56 | 0.53 | 0.55 | 0.58 | 0.79 | 0.9 | 0.79 | 0.92 | 0.87 | 0.90 | 0.95 | Yang et al. (2019) |
| Granite | 0.61 |  | 0.5 | 0.56 | 0.52 |  | 0.54 | 0.59 |  | 0.82 | 0.92 | 0.85 |  | 0.89 | 0.97 | Yang et al. (2019) |

Note: *ε*i is the elastic modulus of intact samples, *ε*c is the elastic modulus of pre-cracked samples.

Table A4

Crack initiation stress and initiation angle of samples containing a single flaw.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material | *σ*p(MPa) | *β* (°) | | | | | | | *σ*ci /*σ*p | | | | | | | Source |
| 0° | 15° | 30° | 45° | 60° | 75° | 90° | 0° | 15° | 30° | 45° | 60° | 75° | 90° |
| Rock-like material | 47.29 |  | 85 | 69.1 | 54.6 | 46.7 | 27.6 |  |  | 0.85 | 0.85 | 0.86 | 0.93 | 0.95 |  | Zhuang et al. (2014) |
| Rock-like material | 47.29 |  | 88.7 | 74.7 | 64.4 | 55.6 | 36 |  |  | 0.86 | 0.86 | 0.87 | 0.95 | 0.96 |  | Zhuang et al. (2014) |
| Rock-like material | 47.29 |  | 101.8 | 81.7 | 75.2 | 57.9 | 37.4 |  |  |  |  |  |  |  |  | Zhuang et al. (2014) |
| Rock-like material | 47.29 |  |  | 109.3 | 86.8 | 73.8 | 64.9 | 40.2 |  |  |  |  |  |  |  | Zhuang et al. (2014) |
| Rock-like material | 55 |  |  |  |  |  |  |  | 0.49 |  | 0.51 | 0.5 | 0.6 | 0.7 | 0.73 | Lee and Jeon (2011) |
| Rock-like material |  | 126 | 110 | 99 | 89 | 87 |  |  |  |  |  |  |  |  |  | Lin et al. (2019a) |
| Sandstone | ~50 | 90 | 88 | 90 | 81 | 35 |  |  | 0.56 | 0.6 | 0.77 | 0.82 | 0.87 | 0.99 | 0.9 | Miao et al. (2018) |
| Sandstone | ~50 | 90 | 81 | 72 | 53 | 25 |  | 0 | 0.87 | 0.81 | 0.86 | 0.88 | 0.89 | 0.82 | 0.99 | Miao et al. (2018) |
| Sandstone | ~50 | 78 | 46 | 71 | 50 |  | 27 |  | 0.74 | 0.93 | 0.69 | 0.75 | 0.96 | 0.97 | 0.97 | Miao et al. (2018) |
| Sandstone | ~50 | 77 | 85 |  | 30 |  |  |  | 0.79 | 0.91 | 0.89 | 0.51 | 0.46 | 0.73 | 0.38 | Miao et al. (2018) |
| Gypsum |  | 95 |  | 95.5 | 88.1 | 79.7 | 53.8 |  | 0.81 |  | 0.81 | 0.93 | 0.99 |  |  | Wong and Einstein (2006) |
| Gypsum |  | 89.7 | 108.7 | 106.1 | 95.5 | 75.4 | 51.7 |  | 0.46 | 0.7 | 0.80 | 0.91 | 0.97 | 1 |  | Wong and Einstein (2006) |
| Gypsum | 47.4 |  |  |  |  |  |  |  |  | 0.77 | 0.83 | 0.83 | 0.67 | 0.9 |  | Zhao et al. (2019) |
| Marble | 113.4 |  |  |  |  |  |  |  | 0.74 |  | 0.95 | 0.98 |  |  |  | Liu et al. (2020) |
| PMMA | 139 |  |  |  |  |  |  |  | 0.31 |  | 0.20 | 0.19 | 0.24 | 0.43 |  | Lee and Jeon (2011) |

Jin, J., Cao, P., Chen, Y., et al., 2017. Influence of single flaw on the failure process and energy mechanics of rock-like material. Comput. Geotech. (86), 150–162.

Lee, H., Jeon, S., 2011. An experimental and numerical study of fracture coalescence in pre-cracked specimens under uniaxial compression. Int. J. Solids Struct. (48), 979–999.

Li, D., Wang, E., Kong, X., Ali, M., Wang, D., 2019a. Mechanical behaviors and acoustic emission fractal characteristics of coal specimens with a pre-existing flaw of various inclinations under uniaxial compression. Int. J. Rock Mech. Min. Sci. (116), 38–51.

Li, S., Zhang, D., Bai, X., et al., 2019b. Experimental Study on Mechanical Properties, Acoustic Emission Energies and Failure Modes of Pre-cracked Rock Materials under Uniaxial Compression. Pure Appl. Geophys. (176), 4519–4532.

Lin, H., Yang, H., Wang, Y., Zhao, Y., Cao, R., 2019. Determination of the stress field and crack initiation angle of an open flaw tip under uniaxial compression. Theor. Appl. Fract. Mech. (104), 102358.

Liu, L., Li, H., Li, X., Wu, R., 2020. Full-field strain evolution and characteristic stress levels of rocks containing a single pre-existing flaw under uniaxial compression. Bull. Eng. Geol. Environ. (79), 3145–3161.

Miao, S., Pan, P.Z., Wu, Z., Li, S., Zhao, S., 2018. Fracture analysis of sandstone with a single filled flaw under uniaxial compression. Eng. Fract. Mech. (204), 319–343.

Wong, L.N.Y., Einstein, H., 2006. Fracturing behavior of prismatic specimens containing single flaws. In: Proceedings of the 41st U.S. Rock Mechanics Symposium - ARMA’s Golden Rocks 2006 - 50 Years of Rock Mechanics

Yang, S.Q., Huang, Y.H., Tian, W.L., Yin, P.F., Jing, H.W., 2019. Effect of High Temperature on Deformation Failure Behavior of Granite Specimen Containing a Single Fissure Under Uniaxial Compression. Rock Mech. Rock Eng. (52), 2087–2107.

Yang, S.Q., Jing, H.W., 2011. Strength failure and crack coalescence behavior of brittle sandstone samples containing a single fissure under uniaxial compression. Int. J. Fract. (168), 227–250.

Zhao, C., Niu, J., Zhang, Q., Zhao, C., Zhou, Y., 2019. Failure characteristics of rock-like materials with single flaws under uniaxial compression. Bull. Eng. Geol. Environ. (78), 593–603.

Zhu, T., Jing, H., Su, H., et al., 2016. Physical and mechanical properties of sandstone containing a single fissure after exposure to high temperatures. Int. J. Min. Sci. Technol. (26), 319–325.

Zhuang, X., Chun, J., Zhu, H., 2014. A comparative study on unfilled and filled crack propagation for rock-like brittle material. Theor. Appl. Fract. Mech. (72), 110–120.