

The list of Figures

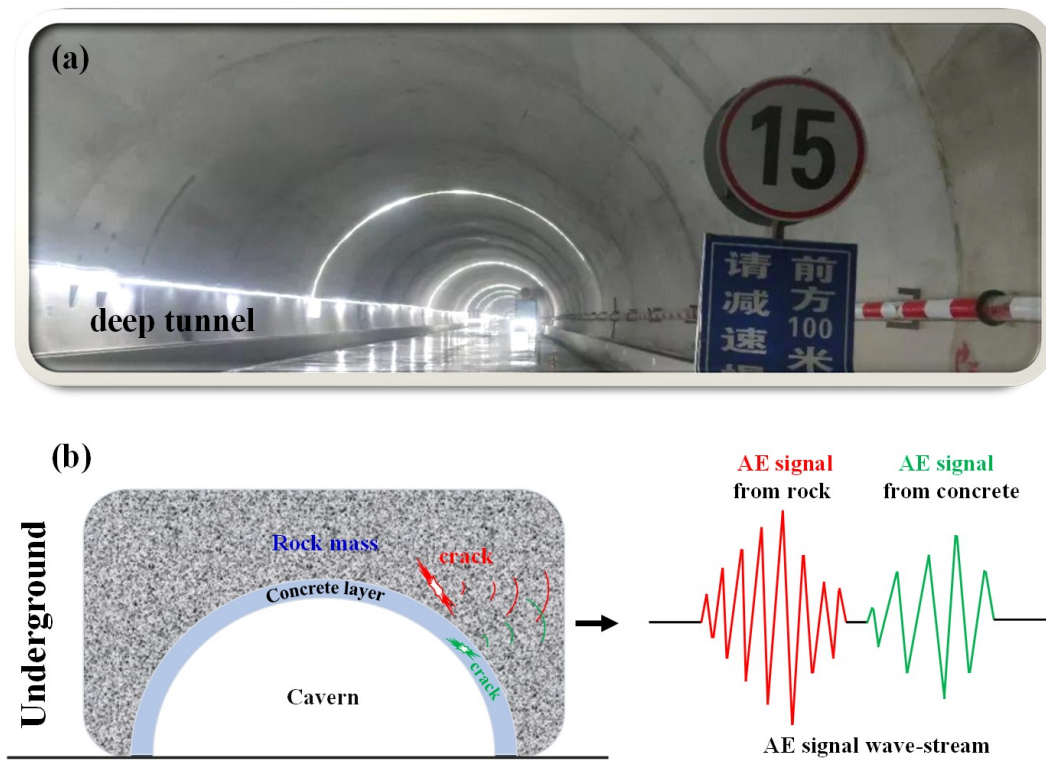


FIGURE 1 Rock-concrete composite structural schematic diagram. (a) Take developing tunnel as a typical case. (b) The mixing damage and corresponding AE wave-stream.

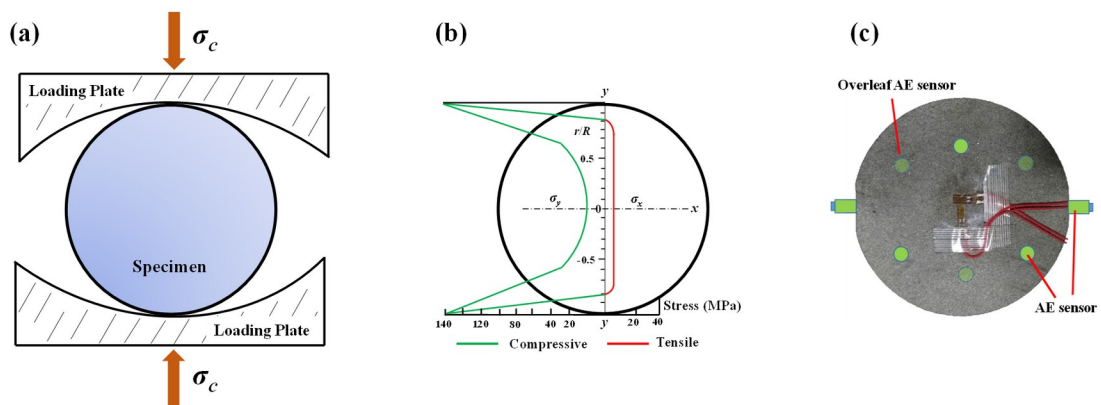


FIGURE 2 Diagram of Brazilian split test. (a) Loading unit. (b) Stress distribution. (c) Real object and AE sensor location.

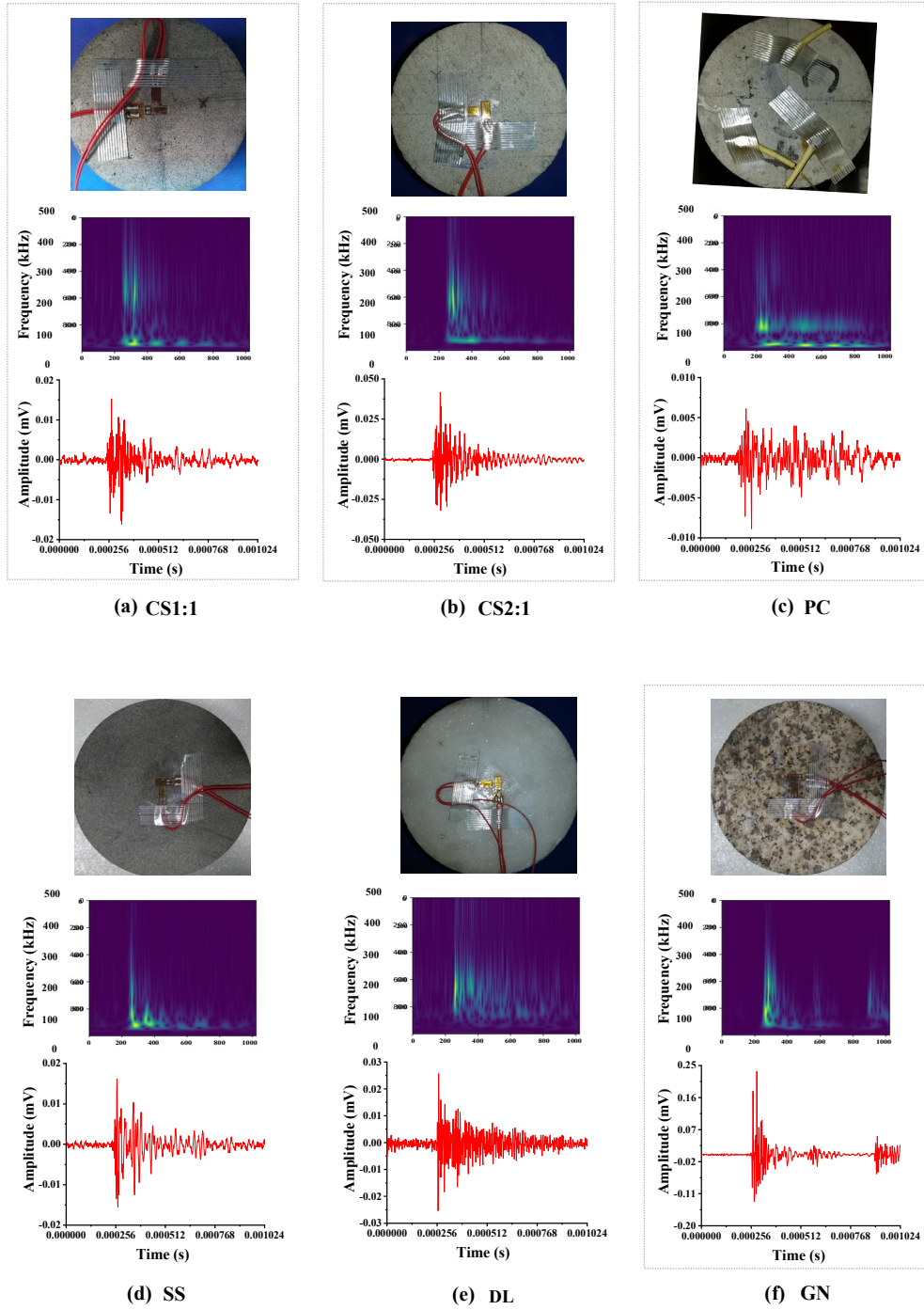


FIGURE 3 AE waveforms and time-frequency diagrams of different materials during failure under Brazilian split tests.

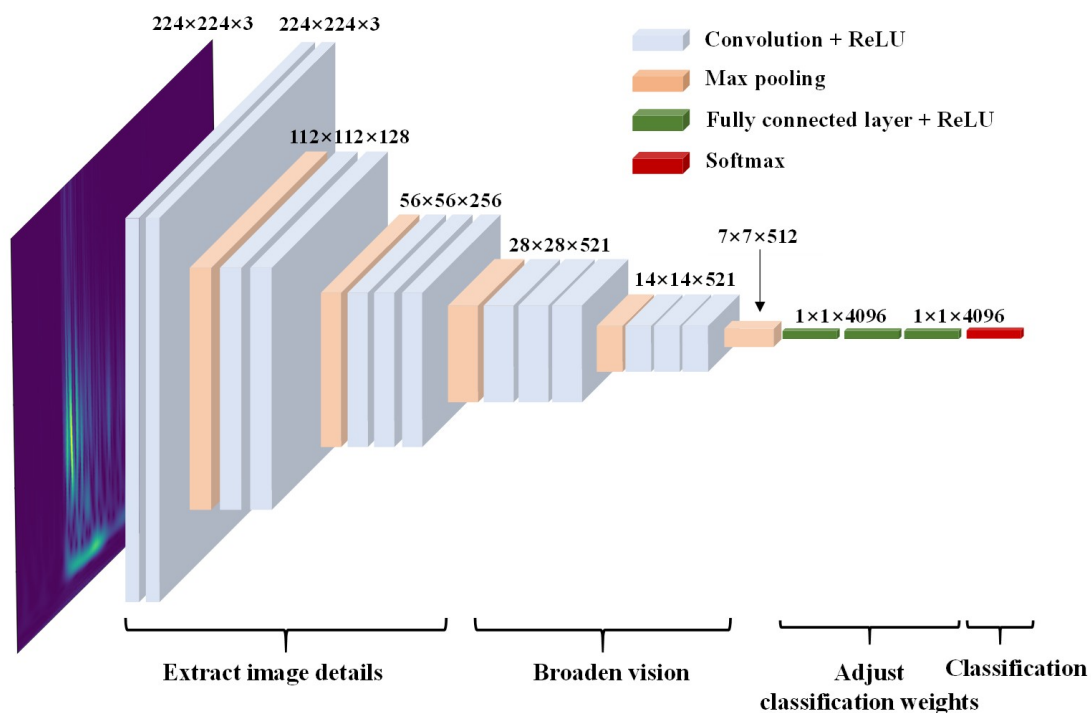


FIGURE 4 Structure diagram of the VGG16 model.

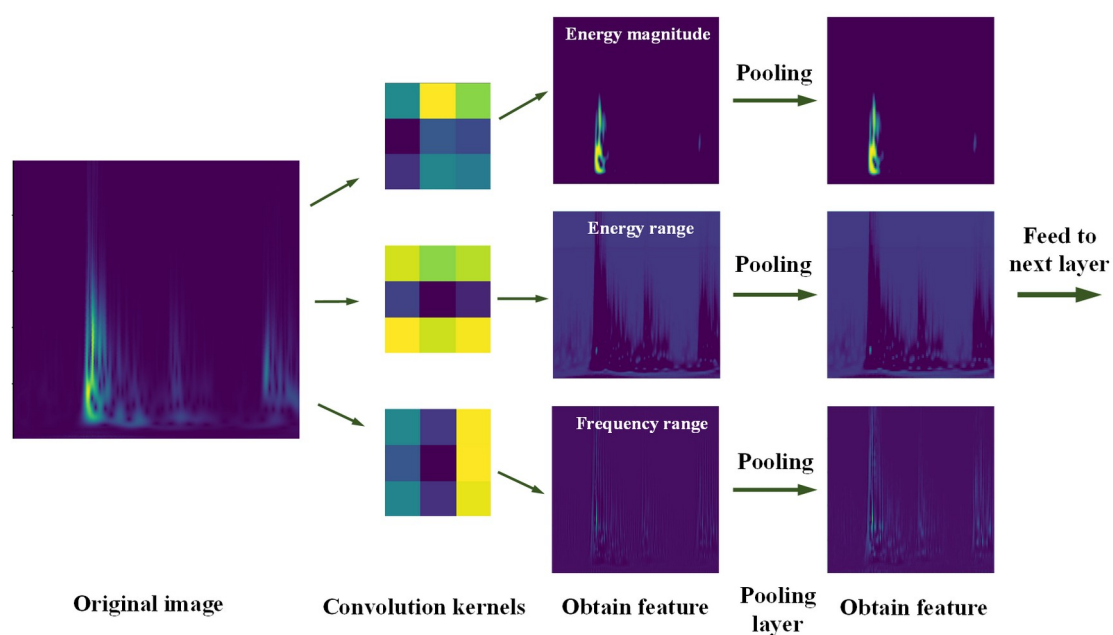


FIGURE 5 The working principle of feature extraction of the VGG16 CNN model.

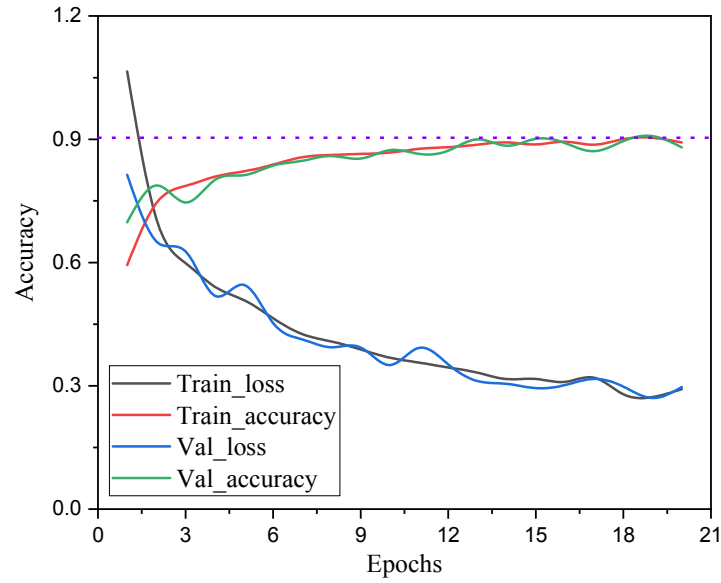


FIGURE 6 The recognition accuracy of the CNN model that only trained the fully connected layers. The Train_accuracy and Train_loss are the recognition accuracy and the loss value of the CNN model during trained the training dataset, respectively. The Val_accuracy and Val_loss are the recognition accuracy and the loss value of the CNN model during tested the testing dataset, respectively.

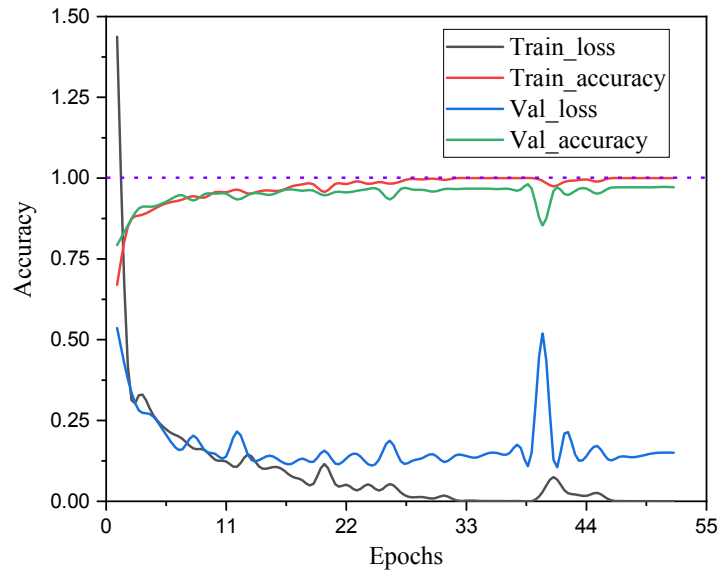


FIGURE 7 The recognition accuracy of the CNN that trained the top convolutional layer.

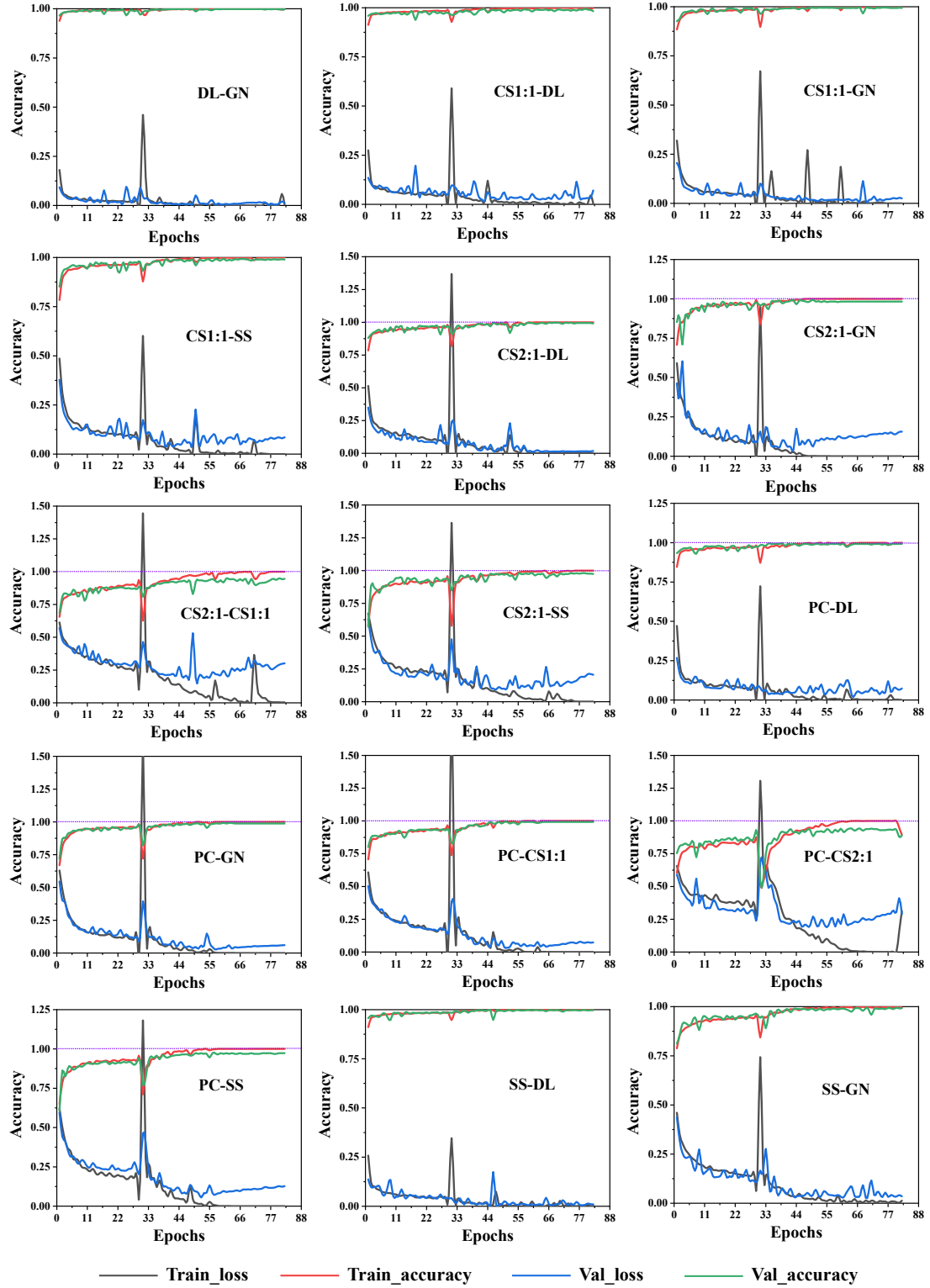


FIGURE 8 Recognition accuracy and loss value for pairwise comparisons.

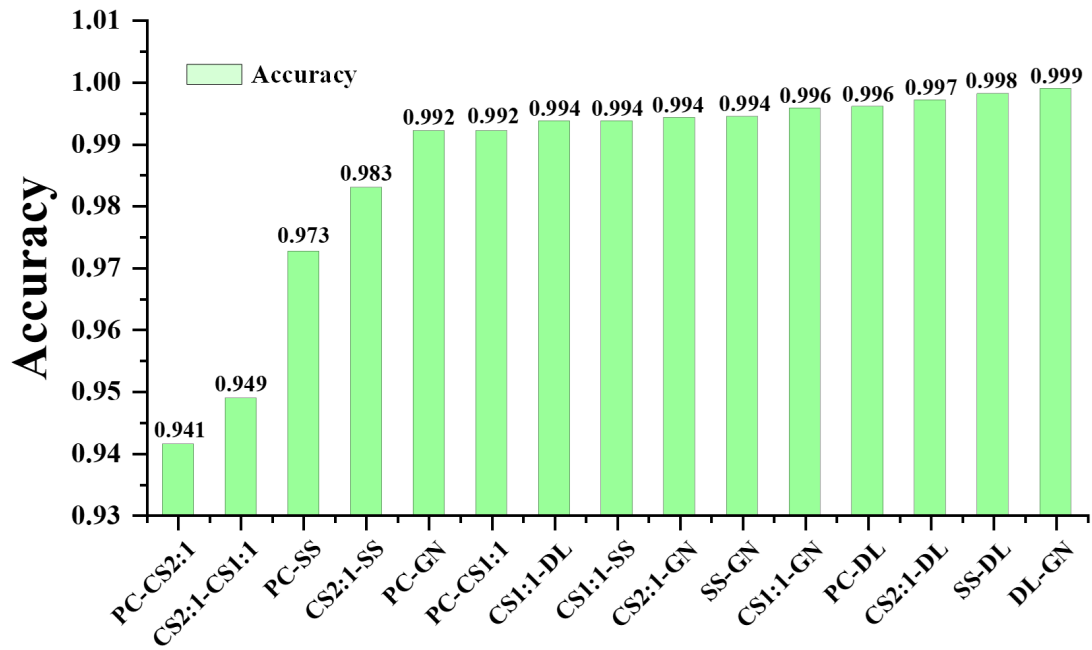


FIGURE 9 Recognition accuracy between pairwise comparisons.

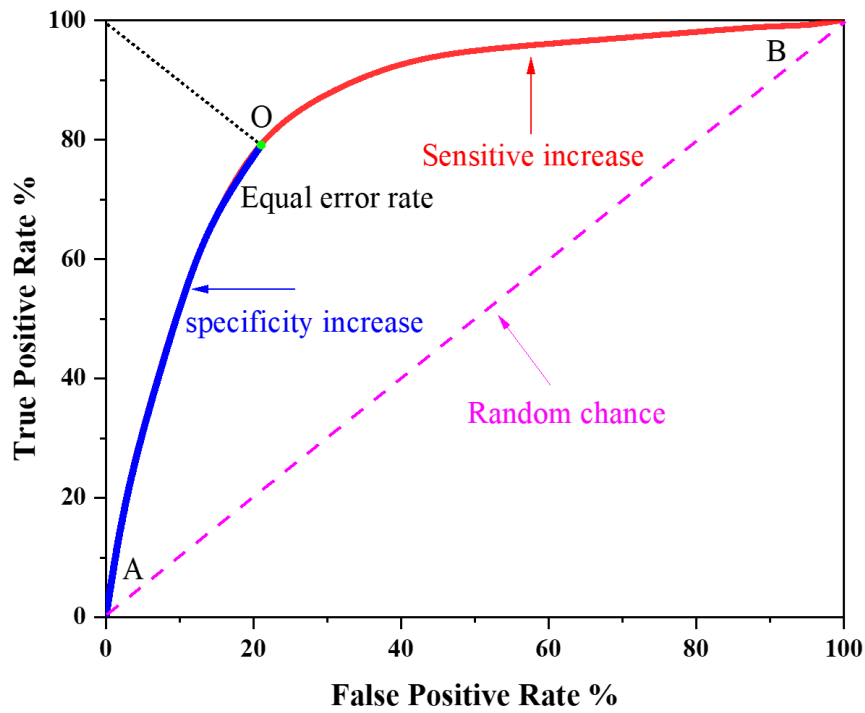


FIGURE 10 Schematic diagram of the ROC curve.

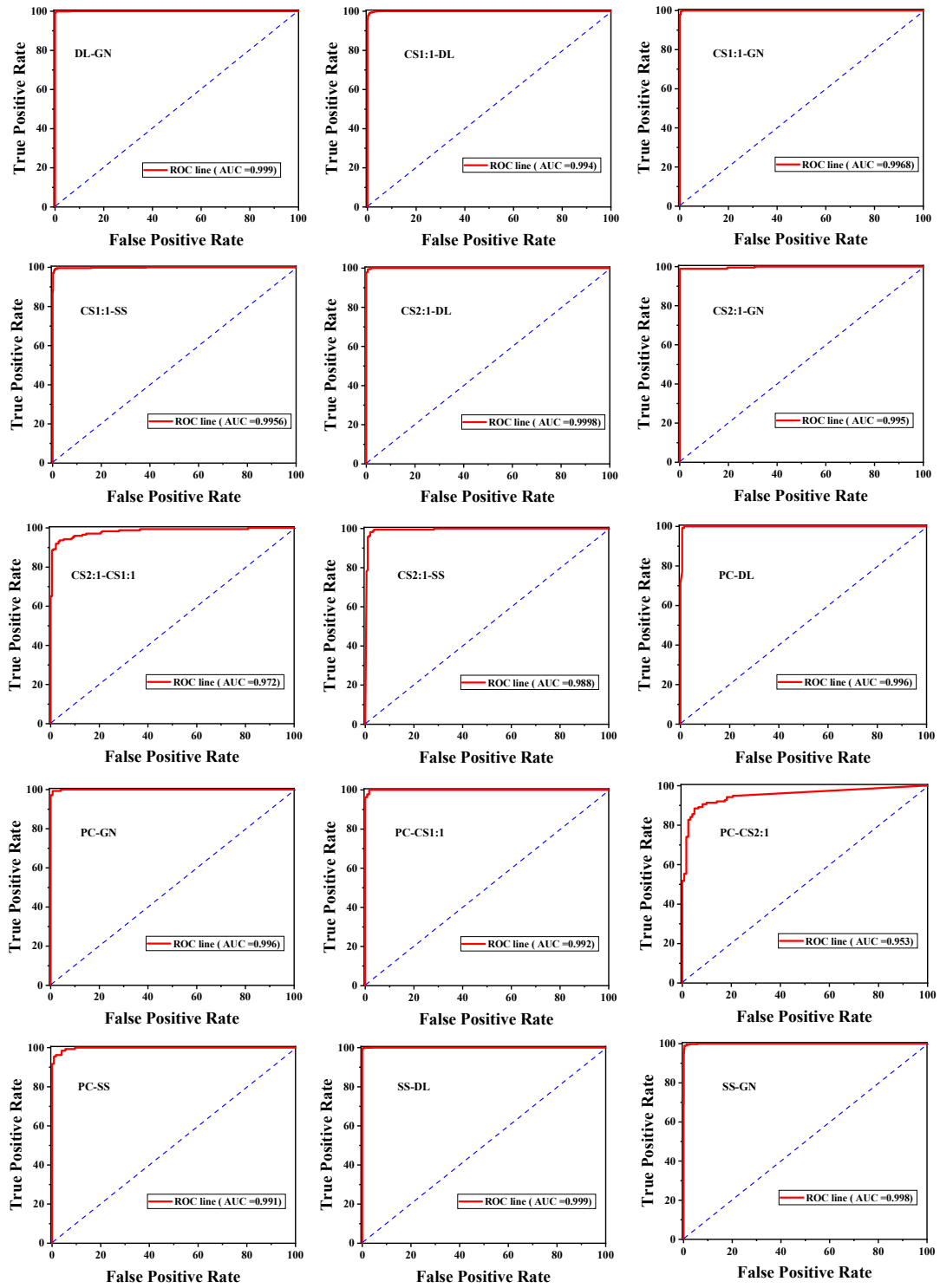


FIGURE 11 ROC evaluation chart of comparison results between different materials.

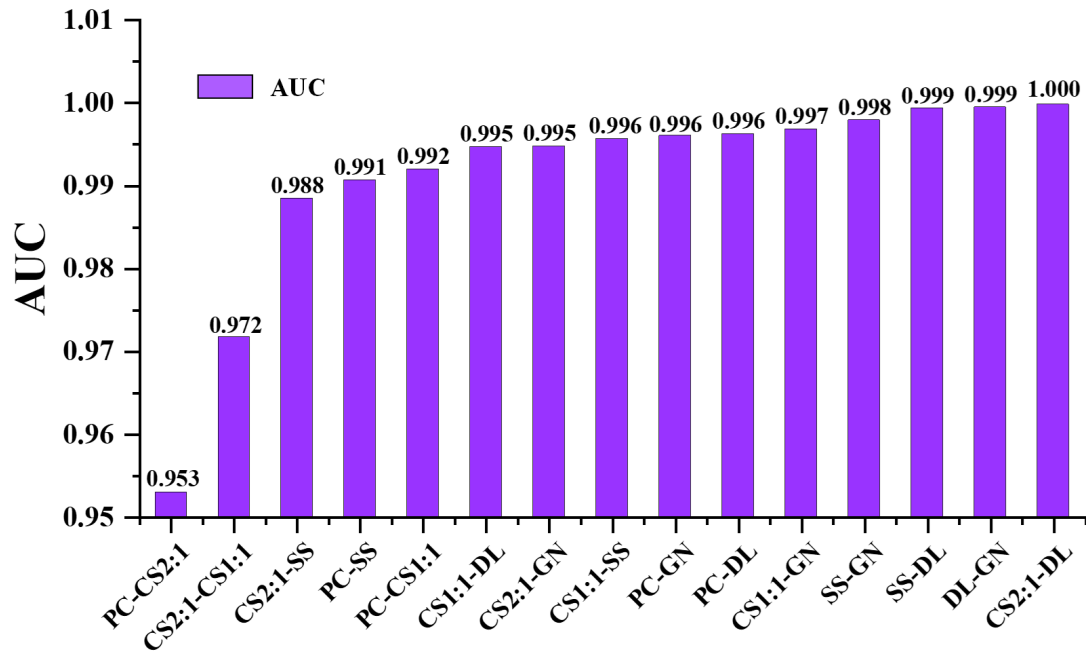


FIGURE 12 AUC chart of comparison results between different materials.

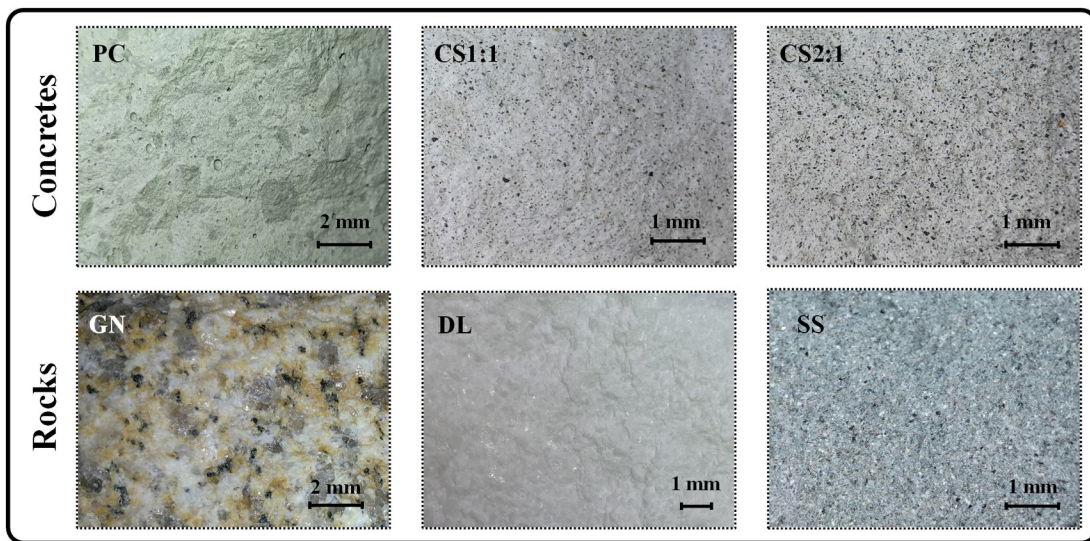


FIGURE 13 The shape and distribution of mineral particles.

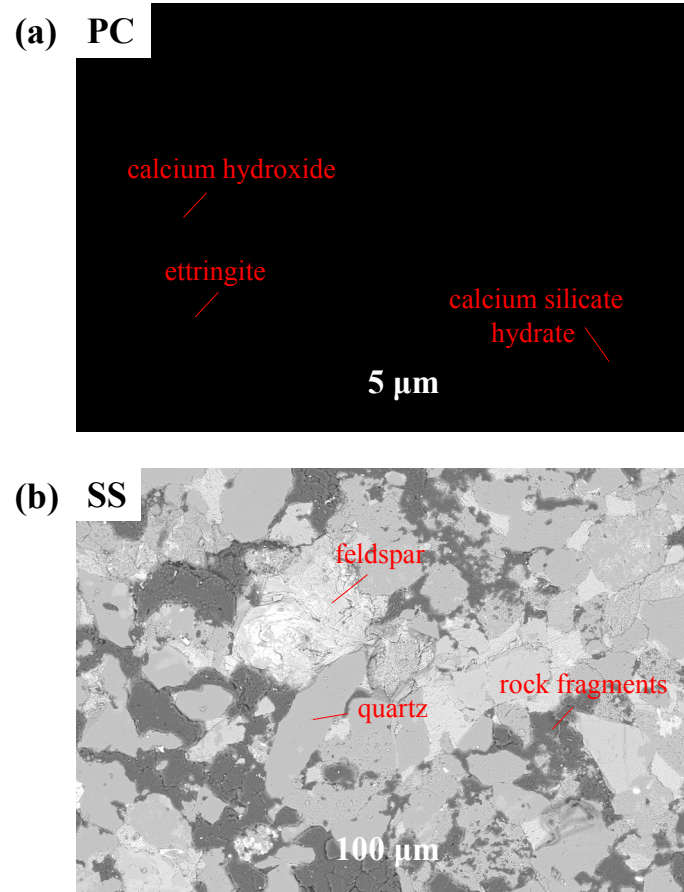


Fig. 14. Comparison of the mineral particles by SEM observation.