Zircon U–Pb geochronology and Sr–Nd–Hf isotopic geochemistry of the Yuanzhuding Granitoid Porphyry, Shi-Hang Zone, South China: Implications for petrogenesis and Cu–Mo mineralization

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The Shi-Hang zone is an important NE–SW-trending Mesozoic magmatic belt in southern China that is dominated by granites with high εNd(t) values and young TDM model ages. Here, we present zircon U–Pb ages, major and trace element whole-rock compositions, and Sr–Nd–Hf isotope data for the Yuanzhuding porphyritic granitoids, located in the southwest of the Shi-Hang zone, and use these data to determine the origin of this granitoid and its relationship to Cu–Mo mineralization. Zircon U–Pb dating indicates that these granitoids were emplaced in the Later Jurassic (~158 Ma), and they have initial 87Sr/86Sr ratios of 0.70941–0.71398, εNd(t) values of –3.15 to –2.02, and in situ zircon εHf(t) values of +1.71 to +6.17. Whole-rock geochemical and isotopic data suggest that these granitoids were formed by partial melting of Proterozoic metasedimentary basement within the lower crust, with additional input at relatively high temperatures (~790°C) from basaltic magmas. These magmatic systems are highly oxidized. This process played a crucial role in the development of Cu–Mo mineralization within the Yuanzhuding that is genetically related to these granites. The discovery of the Yuanzhuding deposit indicates that the Shi-Hang zone should be considered prospective for mineral exploration for porphyry Cu–Mo deposits.

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Role of material properties on Tio_2 nanoparticle agglomeration

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Emerging nanomaterials are being manufactured with varying particle sizes, morphologies, and crystal structures in the pursuit of achieving outstanding functional properties. These variations in these key material properties of nanoparticles may affect their environmental fate and transport. To date, few studies have investigated this important aspect of nanoparticles' environmental behavior. In this study, the agglomeration kinetics of ten different TiO_2 nanoparticles (5 anatase and 5 rutile each with varying size) was systematically evaluated. Our results show that, as particle size increases, the surface charge of both anatase and rutile TiO_2 nanoparticles shifts toward a more negative value, and, accordingly, the point of zero charge shifts toward a lower value. The colloidal stability of anatase sphere samples agreed well with DLVO theoretical predictions, where an increase in particle size led to a higher energy barrier and therefore greater critical coagulation concentration. In contrast, the critical coagulation concentration of rutile rod samples correlated positively with the specific surface area, i.e., samples with higher specific surface area exhibited higher stability. Finally, due to the large innate negative surface charge of all the TiO_2 samples at the pH value (pH=8) tested, the addition of natural organic matter was observed to have minimal effect on TiO_2 agglomeration kinetics, except for the smallest rutile rods that showed decreased stability in the presence of natural organic matter.

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