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Co-pyrolysis of lignite and biomass in a well-swept fixed bed reactor

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Co-pyrolysis of lignite and biomass under nitrogen gas was performed in a well-swept fixed bed reactor. The effect of blending ratio and heating rate of lignite and biomass on product distribution of pyrolysis process investigated under pyrolysis temperatures of 500°C. In the range of the experimental conditions investigated the yield of the product is proportional to the percentage of biomass and lignite in the mixture. On the other hand, considerable synergetic effects were observed during the co-pyrolysis in a well swept fixed bed reactor leading to increase in oil yield. Maximum pyrolysis oil yield was obtained with 15 wt% of lignite mixed with biomass, as compared to the expected ones, calculated as the sum of oil fractions produced by pyrolysis of each separated component. These findings can potentially help to understand and predict the behavior of lignite/biomass blends in practical liquefaction systems.

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A new complementary approach to property driven design of Ti alloys for biomedical applications

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Titanium alloys consisting of nontoxic elements, such as Nb, Mo, Ta, and Zr has become the material of choice for orthopedic implants, due to their corrosion resistance, biocompatibility, high strength and wear resistance. However, stress shielding which deteriorates the quality of most metallic implants by inducing re-sorption processes is still a major drawback to its use. Several researchers in this field have traced the origin of this phenomenon to composition, and processing induced structural effects on properties of materials. The development and application of predictive modeling and simulation are transforming the discovery process. To this end, ab initio theoretical calculation was used to evaluate the chemical and crystallographic identities of the composite phases, their volume fractions/distributions, in addition to their influence on the elastic Young's modulus of new Ti-Mo-Nb-Zr alloys. To compare theoretical data with experiment, a series of the designed alloys were prepared and characterized. This led to the fabrication of new metastable β-type Ti-6Mo-Nb-Zr (at. %) alloys with ultralow Young's modulus (30.25GPa to 48GPa, versus ~30GPa for human bone) by alloying and thermomechanical treatments (i.e., heat treatment and swaging). The agreement between the predictions and experimental data sheds light on the decisive influence of multiphase composites on properties of polycrystals. The study indicates that this approach can be highly beneficial as it may lead to something outlandish with respect to reducing the Young's modulus of metallic biomaterials, which is pertinent to preventing stress shielding and bone resorption in orthopedic implants.

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