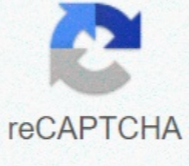




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An isotoric pressure sensor method was employed to generate the dissociation/equilibrium data in the temperature, pressure, and TBAB composition ranges of 275–291 K, 0.5–5.5 MPa, and 5–20 wt %, respectively. The experimental results reveal that in the case of wTBAB = 5%, NaCl and MgCl2 with the low concentration of 5% have a promotion effect for the systems of CH4 + TBAB + NaCl + H2O, CH4 + TBAB + MgCl2 + H2O, and CH4 + TBAB + NaCl + MgCl2 + H2O and shift the dissociation curve toward milder region (higher temperature and lower pressure). However, in the case of wTBAB = 20%, NaCl and MgCl2 play an inhibition role in all of the aforementioned systems. A thermodynamic model was developed based on the van der Waals-Platteeuw (vdWP) solid solution theory, to predict the behavior of methane in the presence of the promoter in saline water. The Peng-Robinson equation of the state (PR EOS) is used to describe the thermodynamic properties of the gas phase, and the electrolyte non-random two-liquid (e-NRTL) activity coefficient model is employed to determine the activity coefficient of water and promoter in the electrolyte solution. The presented model results are in satisfactory agreement with the experimental data generated in this work. The discrepancy of the model results with experimental is 10.78%. Page 4In this work, a model for the thermal conductivity of nonpolar and polar substances is developed based on the geometric similitude concept between the P-v (molar volume)–T and T-k (thermal conductivity)–P plots. The Redlich-Kwong equation of state is used to perform the geometric similitude. The parameters of the model are estimated by fitting experimental data of saturated liquid and saturated vapor. Generalized expressions in terms of the normal boiling point are proposed for the parameters of n-alkanes and n-alcohols. The calculated average deviations are 7.63 and 8.55%, respectively, for the n-alkanes and the n-alcohols used to develop the generalized expressions. Also, some predictive calculations are performed, and deviations below 10.62 and 9.42% are obtained for n-alkanes and n-alcohols, respectively. In total, 2412 experimental data (952 correlated data and 1460 predicted data) in the temperature range of 95– to 645.5 K and pressures below 906.4 bar have been considered. The empirical model has been extended to binary and ternary mixtures using several approaches. In total, 16 mixtures in the temperature range between 287.55 and 345.46 K at 1.01 bar are evaluated. The deviations are below 4.63% when one binary interaction parameter is used. In general, the results indicate that the empirical model is simpler than the other models reported in the literature and generates adequate results.Page 5Lignin dissolution is of great importance for the valorization of lignin, and development of novel efficient solvent systems is a crucial topic. Herein, 17 kinds of 1,5-diazabicyclo[5.4.0]5-undecene-based eutectic molecular liquids (EMLs) were designed for dissolution of industrial lignins. The solubility of lignin in the EMLs significantly depended on the types of the EMLs and lignin. Also the relationship between lignin solubility and the solvatochromic parameters (α, β, and n*) varied significantly based on the EMLs and the types of lignin.Page 6Spout deflection is a common instability phenomenon in spout-fluidized beds. The hydrodynamics of spout deflection under several key operating variables, including static bed height (H0), background velocity (Ubg), and reactor column width (W), is investigated by means of the computational fluid dynamic-discrete element method (CFD-DEM) coupling approach. The results show that non-alternating spout deflection can be easily observed when the H0 is larger than 236 mm or the W is less than 0.14 m in this study. For alternating spout deflection, first, there is an upper limit for its amplitude because of the self-locking phenomenon in the bottom corner. Large W promotes the regularity, while the effects of H0 on regularity is neglectable. Thirdly, the main frequency of the alternating spout deflection reduces with increasing H0 and increasing Ubg and finally stabilizes at 1.7 Hz. This study sheds light on the design, optimization, and operation of spout-fluidized beds. Page 7The influence of dispersed-phase viscosity on droplet breakup in a pump-mixer was determined using a direct measurement technique, which was performed using a high-speed online camera. The experimental results show that the interfacial stress and interfacial viscous stress can be applied to characterize the influence of the interfacial tension and dispersed-phase viscosity on drop breakup, respectively. The daughter droplet size presents a bell-shaped distribution and is slightly dependent on the drop restoring stress. An empirical correlation of the drop breakup frequency function is established to include the influence of the dispersed-phase viscosity. Moreover, the new correlation reveals a clear physical relationship between the variables of physical properties and hydraulic parameters, which strengthens its extensibility when applied to other systems or equipment. Page 8LEARN ABOUT THESE METRICSArticle Views are the COUNTER-compliant sum of full text article downloads since November 2008 (both PDF and HTML) across all institutions and individuals. These metrics are regularly updated to reflect usage leading up to the last few days.Citations are the number of other articles citing this article, calculated by Crossref and updated daily. Find more information about Crossref citation counts. The Altmetric Attention Score and how the score is calculated. Page 9Shale is a kind of heterogeneous porous medium, which has a large number of nanopores. A model for shale gas flow is proposed and validated with published results. The transport mechanisms and the effect of surface diffusion are investigated. The results show that when the diameter of shale nanopore is 1 nm, the surface diffusion is dominant. With the increase in Knudsen number, the surface diffusion permeability decreases gradually. When the pore diameter is 8 nm, the Knudsen diffusion is dominant at a high Knudsen number. At low pressure, the apparent permeability predicted by the present model considering the surface diffusion is larger than that without considering the surface diffusion. At high pressure, the apparent permeability decreases when surface diffusion is considered. The study offers theoretical support for numerical simulations of shale gas development. Page 10Page 11This article reports a research aimed at investigating agglomeration phenomena during fluidized-bed thermochemical processing of olive husk biomass and their mitigation, taking into account both combustion and gasification conditions. Agglomeration is due to the presence of alkalis in fuel ash producing low-melting compounds in combination with SiO2 present in common bed materials (e.g., silica sand). The use of kaolin and fireclay as additives and in some cases as bed materials for inhibiting bed agglomeration was investigated. Experiments were carried out in an alumina crucible and a fluidized bed at 900 °C and were complemented by scanning electronic microscopy (SEM) and X-ray diffraction (XRD) analyses of the collected samples. Fireclay proved to be mechanically resistant to abrasion and not prone to forming low-melting-temperature compounds. As in the case of kaolin, which has a similar composition, the mechanism of alkali neutralization has been attributed to the formation of K2O–Al2O3–2SiO2 and K2O–3CaO–6SiO2 ternary compounds having a higher melting point with respect to that of the K2O–4SiO2 binary compound. For the investigated biomass, the minimum amount of fireclay needed to prevent agglomeration was around 16 mg/gfuel. Page 12Microbial species exhibit sophisticated interdependencies as strategies to coexist in communities. Human health and disease are critically dependent on the compositions and structures of these communities. Unraveling the underlying interdependencies would help engineer natural and synthetic microbial communities, central to modern food and healthcare applications. Here, we constructed a synthetic microbial community of seven naturally co-occurring oral bacteria and employed a bottom-up approach to understand the role of interspecies interactions in deciding the structure of this community. In particular, we focused on the abundance of the species Actinomyces viscosus, implicated in the virulence of oral microbial biofilms and dental caries. The community showed strong co-occurrence of fifth-order interactions. The abundance of A. viscosus was high in monoculture, low in the presence of some but not all of the other species, and high again in the seven-species community. To understand these interactions, we determined the influence of the various species in different combinations on A. viscosus. Two species, Streptococcus mitis and Lactobacillus casei, individually strongly suppressed A. viscosus. This suppression could not be reversed by any of the other species in all possible combinations, except when they were all simultaneously present. Thus, the need for the simultaneous presence of the remaining four species to overcome the influence of S. mitis and L. casei on A. viscosus implied that the seven-species community structure was due to a fifth-order interaction that eclipsed the pairwise interactions. We employed a generalized Lotka–Volterra model to quantify these interactions. The interactions captured the structure of a new community containing the seven species and an additional species, validating the high-order interaction as a handle to tune the community structure. Overall, our study demonstrates the existence of high-order interactions that could define the structure of multispecies microbial communities. Page 13Fabricating a uniform melt-blown web was a complicated engineering problem. A complementary study to our previous model was conducted to aid in the optimization of the prediction of fibrous web formation. The air velocity distribution on a collector was first investigated by computational fluid dynamics software and hot-wire anemometer measurement. The numerical model consisting of beads and poles was used to describe the fiber behavior, such as movement and bending, on the collector. The fiber positions were predicted by calculating the final lay-down positions of beads. The variation coefficient of the basis weight was introduced to evaluate the uniformity of the fibrous web. A larger variation coefficient represented worse uniformity, while a smaller variation coefficient represented better uniformity. Additionally, the effects of the processing conditions on the web uniformity were investigated by the presented model. The entire modeling studied the mechanism of fibrous web formation and evaluated the web uniformity. Page 14With the goal of simultaneous removal of elemental mercury and arsine from simulated yellow phosphorus off-gas, a series of Cl–Ce modified activated carbon samples were prepared via an impregnation method and investigated. The Cl3–Ce10/AC exhibited the best performance at 150 °C, with an Hg0 removal efficiency of 92.2%, and the reaction time of AsH3 removal efficiency greater than 90% was 15.5 h. The presence of Hg0 had little impact on AsH3 removal, but conversely AsH3 significantly reduced Hg0 removal efficiency. The effects of individual flue gas components on the simultaneous removal of Hg0 and AsH3 were also studied. O2 clearly promoted the simultaneous removal of Hg0 and AsH3 and CO had almost no influence, while H2S and water vapor inhibited the removal process. The physicochemical properties of the samples were characterized using BET, FESEM-EDS, XRD, and XPS. By combining experimental results with physical and chemical characterization, a mechanism for simultaneous removal of Hg0 and AsH3 was proposed. It was found that chemical adsorption and catalytic oxidation occurred on the surface of the samples, due to the presence of chlorine covalent bonds and cerium oxides, and that the presence of cerium makes it easier for mercury to combine with chlorine. The main products in the used samples were found to be HgCl2, HgO, and As2O3. Page 15The use of solar energy to produce metals from their oxides via the carbothermic reduction process is a cleaner alternative to traditional combustion-based processes with an added value of a significantly reduced CO2 emission footprint. In this study, the potential contribution of solar energy to the pyrometallurgical production of magnesium was analyzed and compared to the common industrial process. The most energy-consuming step is the carbothermic reduction of the oxide. The reduction was thermodynamically examined and experimentally investigated. While previous studies in the field were based mostly on using MgO, this work focused on dolomite (CaCO3–MgCO3) as the feedstock for the carbothermic reduction process. A thermogravimeter (TGA) was used to investigate the kinetics of the reaction under different conditions. The thermogravimetric results show that a full reduction of MgO in dolime (calcined dolomite, MgO–CaO) is achievable around 1600 °C under atmospheric pressure. According to the results, at the same temperature and in the presence of a sufficient amount of carbon, CaO in dolime is reduced to elemental calcium only after the reduction of MgO has ended. Therefore, stepwise coproduction of magnesium and calcium in a single reaction chamber could be possible via carbothermic reduction of dolime. It is also shown that the amounts of magnesium and calcium produced can be controlled by regulating the temperature and dolime-to-carbon ratio. A comparison of carbothermic reduction experiments on different feedstocks indicates that dolime is reduced faster than MgO. These findings indicate the potential of carbothermic reduction of dolime as a promising option to produce magnesium and calcium from dolomite. Page 16Despite the traditional trial and error formulation approach, industries require more rational, time, and money-saving procedures to achieve functional and sensorial objectives. We developed a methodology based on rheology and texture analysis to outline the physical-mechanical properties of aqueous dispersions of acrylic polymers belonging to three different classes: carboxymers, acryloyldimethyltaurate derivatives, and predispersed acrylic polymers. Statistical analyses evidenced a significant correlation between rheological and textural parameters: viscosity (η) correlates with firmness, while storage (G′) and loss (G″) moduli with adhesiveness, and stringiness. The results demonstrated that the combined approach of these two instrumental techniques is useful to discriminate each cosmetic raw material on the basis of their applicative specificities and to rationalize their use in personal care products obtaining a wide range of textural characteristics. Page 17CaO and Fe2O3 are effective mineral sorbents to inhibit the damage of arsenic and selenium release into the atmospheric environment. Density functional theory was applied to explore the adsorption mechanism of different arsenic and selenium species (atom, hydride, oxide, and chloride) on CaO and Fe2O3 surfaces. The effect of the As4O6 cluster on the adsorption behavior of CaO and Fe2O3 surfaces was also examined. The results show that the O top sites serve as the active sites for arsenic and selenium atom adsorption on the CaO(001) surface. For the Fe2O3(001) surface, the adsorption energy of the As atom at the Fe top and O bridge site can reach −381.38 and −439.55 kJ/mol, respectively. The results show that the Fe top site and O bridge site are both effective chemical adsorption sites. CaO and Fe2O3 also exhibit a good performance to adsorb atomic arsenic and selenium under the condition of multicoVERAGE. In addition, the interactions between two adsorbents and complex arsenic/selenium species are weakened in different degrees, but still belong to chemical adsorption. The adsorption of the As4O6 cluster on the CaO surface is mainly attributed to the interaction between As atoms and O atoms on the CaO surface. The As4O6 adsorption on the Fe2O3 surface depends on the interaction between O atoms of As4O6 and Fe atoms on the Fe2O3 surface. However, the interactions can both lead to the formation of more stable arsenate, which contributes to the reduction of detrimental arsenic release. Page 18LEARN ABOUT THESE METRICSArticle Views are the COUNTER-compliant sum of full text article downloads since November 2008 (both PDF and HTML) across all institutions and individuals. 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