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They try to fill their valence shells. What kinds of problems could this pose? How could you overcome these problems? Creating a mechanical bond between the ceramic and the metallic component could pose a problem since the ceramic is ionic in nature and the component is metallically bonded. This can be overcome by creating a slightly roughened surface and choosing a ceramic that has a limited degree of chemical reactivity with the metal which would enhance bonding. Another problem that we face is likely to spallation or debonding of the coating due to the differences in the coefficients of thermal expansion. To overcome this problem, it would be possible to select a ceramic that could have a compatible coefficients coefficients of thermal expansion with the aluminum for the given operating temperature range. Compare the melting temperatures of the two elements and explain the difference in terms of atomic bonding. The differences in melting temperatures can be explained by the types of bonds that bind the elements together. It is expected that since aluminum is a metal that it would have metallic bonding. Silicon on the other hand is a metalloid between metal and non-metal and has covalent bonding. Since covalent bonding has higher binding energy than metallic bonding, we can conclude that the silicon has the higher melting temperature due to the higher strength of the silicon bonds when compared to aluminum. On the same graph, carefully and schematically draw the potential well curves for both metals. Be explicit in showing how the physical properties are manifest in these curves. The well of titanium, represented by A, is deeper higher melting point , has a larger radius of curvature stiffer , and is more symmetric smaller thermal expansion coefficient than the well of aluminum, represented by B. It is expected that SiN would have the higher modulus of elasticity due to its bonding nature covalent compared to iron metallic. Covalent bonds result in higher binding energies thus having a direct result for a higher modulus of elasticity. Which would you expect to have the higher modulus of elasticity? Explain, considering binding energy and atomic radii and using appropriate sketches of force versus interatomic spacing. The smaller Be electrons are held closer to the core, therefore giving a higher binding energy: MgO has ionic bonds. A higher force will be required to cause the same separation between the ions in MgO compared to the atoms in Mg. Therefore, MgO should have the higher modulus of elasticity. Silicon has covalent bonds; aluminum has metallic bonds. Therefore, Si should have a higher modulus of elasticity. What do you expect to happen to the coating when the temperature of the steel is increased significantly? When the structure heats, steel expands more than the coating, which may crack and expose the underlying steel to corrosion. Why is graphite electrically conductive while diamond is not if both are pure forms of carbon? The four allotropes of carbon are diamond, graphite, nanotubes and buckminsterfullerene. In diamond, the carbon atoms are covalently bonded to four other carbon atoms thus leaving no free valence electrons available to conduct electricity. In graphite, the carbon is arranged in layers where the carbon atoms form 3 strong bonds with other carbon atoms, but have a fourth bond between layers which which is a weak van der Waals bond. This results in the fourth electron for each of the carbon atom to be available to conduct electricity. With only six electrons, how is this possible? Chapter2 Chapter2Exercises Skills Learned: Unit conversion, fundamental constants of elements Knovel Problems: K A 2 in.

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