Chemistry of defects in solids

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The properties of materials are strongly influenced by the defects of crystal structure such as two-dimensional planar interfaces as grain boundaries or one-dimensional dislocations. Those are regions with different atomic structures and consequently implementing new properties of solids. Due to segregation of impurities and their accumulation at the defects, the grain boundaries can become weaker and susceptible to intergranular fracture with catastrophic effects on the operation of machines and devices. Hence the chemistry of grain boundaries is of primarily importance for the safe utilization of all kinds of transportation and other facilities. Nitrogen and phosphorus due to their chemical resemblance display a similar enrichment of grain boundaries. Surprisingly, carbon and silicon despite of their chemical resemblance behave entirely unlikely.