

Metallradien, Ionenradien und Wertigkeiten fester metallischer Elemente

Metallic Radii, Ionic Radii, and Valences of Solid Metallic Elements

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Metallic Radii, Ionic Radii, Metallic Valence, Atomic Volume

Metallic radii r_m are correlated with the ionic radii r_i by linear relationships. For groups 1 up to 7 as well as for Al, Ga, In, Tl, Sn, and Pb the ionic radii refer to the maximum valences (oxidation states) as known from compounds according to $r_m \approx 1.16 \cdot (r_i + 0.64)$ [Å]. For groups 8 up to 12, $r_m \approx 0.48 \cdot (r_i + 2.26)$ [Å] with valences $W = 14 - G$ ($G =$ group number). These valences are considered regular (W_r). For groups 1 up to 12, they obey the equation $W_r = 7 - |G - 7|$. According to this equation all outer s electrons and the unpaired d electrons should be involved in chemical bonding, *i.e.* in the cohesion of the element in the solid state. From the melting temperatures and the atomic volumes it is concluded, however, that only 19 out of the 30 d-block elements have regular valences, namely the elements of groups 3, 5, 6, 10, 11 as well as Os, Ir, Zn, Cd, and possibly Ru. All of the non-regular valences are lower than the regular ones. Four of them are integers: Mn 3; Fe, Co 4; Re 6.