Covalent radii revisited†‡

Beatriz Cordero, Verónica Gómez, Ana E. Platero-Prats, Marc Revés, Jorge Echeverría, Eduard Cremades, Flavia Barragán and Santiago Alvarez*

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Z	Element	r	e.s.d.	n
1	H	0.31	5	129
2	He	0.28		
3	Li	1.28	7	5789
4	Be	0.96	3	310
5	B	0.84	3	1770
6	Csp^3	0.76	1	10 000
	Csp^2	0.73	2	10 000
	Csp	0.69	1	171
7	N	0.71	1	2200
8	O	0.66	2	10 000
9	F	0.57	3	10 000
10	Ne	0.58		
11	Na	1.66	9	1629
12	Mg	1.41	7	3234
13	Al	1.21	4	3206
14	Si	1.11	2	10 000
15	P	1.07	3	10 000
16	S	1.05	3	10 000
17	Cl	1.02	4	1987
18	Ar	1.06	10	9
19	K	2.03	12	435
20	Ca	1.76	10	2647
21	Sc	1.70	7	32
22	Ti	1.60	8	231
23	V	1.53	8	389
24	Cr	1.39	5	916
25	Mn l.s.	1.39	5	321
	h.s.	1.61	8	929
26	Fe l.s.	1.32	3	336
	h.s.	1.52	6	1540
27	Co l.s.	1.26	3	5733
	h.s.	1.50	7	780
28	Ni	1.24	4	1030
29	Cu	1.32	4	1149
30	Zn	1.22	4	443
31	Ga	1.22	3	1330
32	Ge	1.20	4	1013
33	As	1.19	4	2015
34	Se	1.20	4	1717
35	Br	1.20	3	2140
36	Kr	1.16	4	5
37	Rb	2.20	9	23
38	Sr	1.95	10	1500
39	Y	1.90	7	30
40	Zr	1.75	7	93
41	Nb	1.64	6	18
42	Mo	1.54	5	97
43	Tc	1.47	7	96
44	Ru	1.46	7	1032
45	Rh	1.42	7	458
46	Pd	1.39	6	1892
47	Ag	1.45	5	1728
48	Cd	1.44	9	19
49	In	1.42	5	546
50	Sn	1.39	4	2999
51	Sb	1.39	5	609
52	Te	1.38	4	692
53	I	1.39	3	451
54	Xe	1.40	9	2
55	Cs	2.44	11	24
56	Ba	2.15	11	3076
57	La	2.07	8	190
58	Ce	2.04	9	47
59	Pr	2.03	7	58
60	Nd	2.01	6	96
61	Pm	1.99		
62	Sm	1.98	8	53
63	Eu	1.98	6	167
64	Gd	1.96	6	178
65	Tb	1.94	5	55
66	Dy	1.92	7	59
67	Ho	1.92	7	48
68	Er	1.89	6	66
69	Tm	1.90	10	15
70	Yb	1.87	8	122
71	Lu	1.87	8	61
72	Hf	1.75	10	53
73	Ta	1.70	8	88
74	W	1.62	7	219
75	Re	1.51	7	476
76	Os	1.44	4	99
77	Ir	1.41	6	131
78	Pt	1.36	5	1768
79	Au	1.36	6	114
80	Hg	1.32	5	137
81	Tl	1.45	7	291
82	Pb	1.46	5	112
83	Bi	1.48	4	51
84	Po	1.40	4	4
85	At	1.50		
86	Rn	1.50		
87	Fr	2.60		
88	Ra	2.21	2	3
89	Ac	2.15		1
90	Th	2.06	6	11
91	Pa	2.00		1
92	U	1.96	7	57
93	Np	1.90	1	22
94	Pu	1.87	1	9
95	Am	1.80	6	11
96	Cm	1.69	3	16

For the transition metals, plotted independently in Fig. 4, we observe a clear decrease in the radius along the first transition series. The deviation of the copper radius from the general trend must be attributed to the plasticity of its coordination sphere that gives several coordination numbers and may even incorporate weakly bonded ligands. We must recall that the slightly large radius of Cu cannot be attributed to the presence of Jahn–Teller distortions in Cu(II) compounds, since we have explicitly excluded five- and six-coordinate compounds to disregard such weak bonds. We must notice also that changes in covalent radii on going from Group 11 to Group 12 elements are biased by the change of reference bonded atom from nitrogen to carbon and we will not attempt to discuss such variations, which might not be significant. The radii for the second transition series elements show an evolution along the period practically parallel to those of the first transition series, with values roughly 0.1 Å longer than for the corresponding first row metal. The third transition series elements present radii that are practically coincident with the second series ones, with the exception of La. Such a behavior is well known and is attributed to the lanthanide contraction.[9] It is worth mentioning that for the later transition elements there seems to be a crossover of the two curves and the size of Au becomes smaller than that of Ag, a fact that was already pointed out by Schmidbaur and coworkers.[31] A similar inversion of the atomic size is apparent for Cd and Hg in Fig. 4.

A feature that must be considered for first row transition elements is the significant difference in bond distances that the same metal presents in its high- and low-spin compounds. Hence, for such metals it is practical to associate a different radius for

