

TEN BEST SOURCES: PYROMETALLURGY

Compiled by Chris Pistorius

1. The geology, geochemistry, mineralogy and mineral beneficiation of platinum-group elements.

L.J. Cabri (ed.): The geology, geochemistry, mineralogy and mineral beneficiation of platinum-group elements. Canadian Institute of Mining, Metallurgy and Petroleum, 2002. ISBN 1-894-47527-5. The platinum industry is a traditionally secretive one; Cabri has done well to draw together much information on the physical metallurgy, mineralogy, and extraction of the platinum-group elements.

2. The Making, Shaping and Treating of Steel.

R.J. Fruehan (ed.): The Making, Shaping and Treating of Steel, 11th Edition, Steelmaking and Refining Volume. AISE Steel Foundation, 1998. ISBN 0-930-76702-0. The best book on steelmaking, for students and steelmakers.

3. Refractory materials, major industrial applications.

P. Hloben: Refractory materials, major industrial applications. Rexxon, 2000. ISBN 0-620-25867-5. Pyrometallurgy is only possible if the high-temperature fluids can be contained; refractories perform this task. This South African author has summarised his experience in the refractory industry, combining comprehensive coverage with accessible writing.

4. Materials Thermochemistry.

O. Kubaschewski, C.B. Alcock & P.J. Spencer: Materials Thermochemistry, 6th edition. Pergamon, 1993. ISBN 0-080-41888-0. All calculations on high-temperature reactions require good thermochemical data, and this is one of the best combinations of background theory and data. It also contains the valuable statement that "generally the aim of any thermochemical calculation in materials production is to obtain values for the equilibrium constant under consideration."

5. Blast furnace phenomena and modelling.

Y. Omori (committee chairman): Blast furnace phenomena and modelling. Elsevier, 1987. ISBN 1-851-66657-7. Blast-furnace ironmaking is the largest-scale process for primary metal production, tapping hundreds of millions of tons of steel per year. While the basic operation has remained the same for at least a hundred years, the understanding of reactions and drivers of efficiency received a major boost when Japanese researchers quenched operating furnaces with nitrogen, and painstakingly dissected and inspected the furnace contents. This book documents the results.

6. Advanced physical chemistry for process metallurgy.

N. Sano, W-K. Lu, P.V. Riboud and M. Maeda (eds.): Advanced physical chemistry for process metallurgy. Academic Press, 1997. ISBN 0-126-18920-0. Pyrometallurgy is applied physical chemistry, as this collection of authors show very well: once you have worked through the thermodynamics and kinetics chapters, those on industrial systems give the bridge from fundamentals to working processes.

7. Phase equilibria spatial diagrams. Phase diagrams.

F. Tamás and I. Pál: Phase equilibria spatial diagrams. Phase diagrams. Their interpretation and anaglyph representation. Iliffe Books, 1970. ISBN 0-592-01248-4. Phase diagrams are commonly used to communicate high-temperature equilibria concisely and visually. Reading and interpreting phase diagrams is a scientific skill which relies on visual and thermodynamic literacy. With 3D glasses, these authors develop both of these in a well-structured text.

8. Fundamentals of steelmaking. Institute of Materials, Minerals and Mining.

E.T. Turkdogan: Fundamentals of steelmaking. Institute of Materials, Minerals and Mining, 1996. ISBN 1-861-25004-5. Turkdogan is the father of much of the science of steelmaking. Here are the data which is the result of that science, with the practical applications.

9. The availability of liquid metal, gas, and molten oxides.

Verein Deutscher Eisenhüttenleute (eds.): Slag Atlas, 2nd edition. Verlag Stahleisen, 1995. ISBN 3-514-60457-9. The availability of liquid metal, gas, and molten oxides (slags) as process products makes for much of the flexibility and effectiveness of pyrometallurgy. The German Iron and Steel Institute sifted and assembled most of the available information on the chemical and physical nature of slags in this single volume.

10. The Mineral Resources of South Africa.

M.G.C. Wilson and C.R. Anhaeusser (eds.): The Mineral Resources of South Africa. Council for Geoscience, Handbook 16, 1998. ISBN 1-875-06152-5. Extractive metallurgists obliterate ores to recover the contained metals. It certainly helps to know what we are working with. Wilson and Anhaeusser assembled an excellent group of guides to all the mineral resources of our country.

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