



Universal Behavior of a Cyclic Oxidation Model

By James L. Smialek

BiblioGov. Paperback. Book Condition: New. This item is printed on demand. Paperback. 26 pages. Dimensions: 9.7in. x 7.4in. x 0.1in. A mathematical model has been generated to represent the iterative, discrete growth and spallation processes associated with cyclic oxidation. Parabolic growth kinetics (k_p) over and a constant spall area (F_s) were assumed, with spalling occurring interfacially at the thickest regions of the scale. Although most models require numerical techniques, the regularity and simplicity of this progression permitted an approximation by algebraic expressions. Normalization could now be performed to reflect all parametric effects, and a universal cyclic oxidation response was generated: $W = 12.3J^{1/2}$ where W is weight change normalized by the maximum and J is the cycle number normalized by the number to reach maximum. Similarly, the total amount of metal consumed was represented by a single normalized curve. The factor $(S-1)\sqrt{F_s k_p \Delta t}$ was identified as a general figure of merit, where S is the mass ratio of oxide to oxygen and Δt is the cycle duration. A cyclic oxidation failure map was constructed, in normalized k_p - F_s space, as defined by the locus of points corresponding...



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