SILICON BURNING II: QUASI-EQUILIBRIUM AND EXPLOSIVE BURNING[1]

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Having examined the application of quasi-equilibrium to hydrostatic silicon burning in Paper I of this series, Hix & Thielemann (1996), we now turn our attention to explosive silicon burning. Previous authors have shown that for material which is heated to high temperature by a passing shock and then cooled by adiabatic expansion, the results can be divided into three broad categories; *incomplete burning, normal freeze-out, and* α*-rich freeze-out*, with the outcome depending on the temperature, density, and cooling time scale. In all three cases, we find that the important abundances obey quasi-equilibrium for temperatures greater than approximately 3×10^9 K, with relatively little nucleosynthesis occurring following the breakdown of quasi-equilibrium. We will show that quasi-equilibrium provides better abundance estimates than global nuclear statistical equilibrium, even for normal freeze-out and particularly for α-rich freeze-out. We will also examine the accuracy with which the final nuclear abundances can be estimated from quasi-equilibrium.

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