

TABLE 1
Pertinent equilibria and free energies for reduction process

Equilibria	ΔG_{873} (kJ/mol)
$\text{CO}_2 + \text{Zn} \longleftrightarrow \text{CO} + \text{ZnO}$	-55
$\text{CO} + \text{CO} \xleftarrow{\text{Fe}} \text{C} + \text{CO}_2$	-18
$\text{CO} + \text{H}_2 \xleftarrow{\text{Fe}} \text{C} + \text{H}_2\text{O}$	-14
$\text{CO}_2 + \text{H}_2 \xleftarrow{\text{Fe}} \text{CO} + \text{H}_2\text{O}$	+4
$\text{CO} + 3\text{H}_2 \xleftarrow{\text{Fe}} \text{CH}_4 + \text{H}_2\text{O}$	-18

REFERENCES

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RAPID PRODUCTION OF GRAPHITE WITHOUT CONTAMINATION FOR BIOMEDICAL AMS¹

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The application of AMS to the detection of ^{14}C makes possible a new class of sensitive experiments in molecular biology. We presently apply this technology to pharmacokinetics of xenobiotics, radio-immune assays and genetic damage and repair. Such experiments inherently produce large numbers of samples for the determination of biological variability in molecular interactions. The samples vary in ^{14}C concentration over many orders of magnitude, sometimes unpredictably. In our initial experiments, we reduced CO_2 to filamentous graphite by hydrogen. Our throughput was limited by the number of reactors (4), and cross-contamination resulted in unacceptable uncertainties. Instead, we modified the known reduction of CO_2 by zinc in a sealed tube in order to rapidly and reproducibly make graphite without contaminations. Titanium hydride is added to the zinc in the bottom of the reaction tube. A smaller inserted tube contains the cobalt catalyst. The CO_2 is transferred from a break-seal combustion tube to the reaction tube through a completely disposable plastic manifold. Samples are transferred at 15-20 per hour. The sealed tubes are heated to 435°C in a muffle furnace. The number of samples to be prepared simultaneously is limited only by the size of the furnace. The process is complete to <1% fractionation within 5 hours. Cross-contamination is much less than 1 part in 50,000. The hydrogen from the decomposing hydride minimizes the production of volatile carbonyls and the transfer of volatile zinc compounds back to the graphite. The ion beams from these graphites are similar in intensity to those from hydrogen-reduced carbon, and no 'burn-in' is required. The isotope ratio among identical samples is reproducibly measured to better than 1%, and backgrounds of 0.7pMC are measured without any precleaning of the metals involved.

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