

OXIDATION OF A THIN FILM OF A CARBONACEOUS CHAR
AT PRESSURES BELOW 10^{-4} TORR (1)

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A study has been made of heterogeneous reactions of molecular oxygen with a thin film of carbonaceous char. The reactions are carried out at low pressures in a stirred-flow reactor whose temperature was maintained at values up to 920°C . The production of CO and CO_2 is first order in oxygen over this temperature range and the activation energies for CO and CO_2 production are 26 and 22 kcal per mole, respectively. A simple mechanism has been proposed to fit the observed experimental facts. This mechanism involves the formation of a peroxy radical site, which can decompose to give molecular oxygen, an O atom and subsequently CO gas, or, a surface oxide which yields CO_2 .

Introduction

The objective of this research has been to study the interaction between various gases commonly found under conditions of thermal ablation during atmospheric reentry with the carbonaceous char formed as a result of the ablation process.

The first gas with which we have worked has been oxygen; oxygen at high temperatures is, of course, one of the more important constituents of the atmosphere interacting with the hot charred ablative material in the practical case.

We fully realize that the ungraphitized char with

FUNDAMENTALS OF GAS-SURFACE INTERACTIONS

Table 3. Percentage CO₂¹⁶⁻¹⁸ Formed During the Reaction of Graphon with a Mixture of O₂¹⁶⁻¹⁶, O₂¹⁸⁻¹⁸, and O₂¹⁶⁻¹⁸. Atom Fraction O¹⁸ in O₂ was 0.527.

Reaction Time, min	Percentage CO ₂ ¹⁶⁻¹⁸		
	Exptl.	Predicted by Reaction (h)	Predicted by Reaction (i)
0	0	0	0
5	49.9	2.6	49.8
10	49.9	2.6	49.8
20	51.8	2.6	49.8
40	51.1	2.6	49.8
60	51.2	2.6	49.8
90	52.4	2.6	49.8

carbon and oxygen and is produced through a dissociated oxygen intermediate.

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IV. References

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