

DEW POINTS OF HOT GASES FROM COAL GASIFICATION PROCESSES

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## Objective and Scope

The long-range purpose of this research is to obtain fundamental physico-chemical data which, when coupled with theoretical results from molecular thermodynamics, will enable calculation of dew points in tar-containing gas mixtures at advanced temperatures and pressures.

## Summary of Progress to Date

Experimental apparatus for measurement of dew-point data has been designed and, in part, constructed. Theoretical work toward data interpretation and correlation has been initiated.

## Detailed Description of Technical Progress

This project consists of three sections, one theoretical and two experimental.

The theoretical section calls first, for a gas-phase equation of state appropriate to mixtures containing a variety of components. A suitable form for this equation of state has been identified and efforts toward its development are now underway. The equation is of the general van der Waals form, using the Carnahan-Starling expression for repulsive forces (1). Attractive forces are separated into nonpolar and polar contributions, each characterized by appropriate coefficients; these must be evaluated from experimental measurements.

Second, the theoretical section calls for a group-contribution method to estimate vapor pressures of heavy hydrocarbons (and their derivatives) as a function of temperature. Two theoretical methods, one based on Prigogine's extended corresponding-states theory (2) and the other based on the kinetic (coupled oscillator) theory of Berthoud (3), are under consideration.

The first experimental project concerns measurement of (small) vapor pressures of heavy hydrocarbons, using Sinke's method (4). Several necessary components for this method have been designed and are now under construction. Also, several instruments, notably the infra-red detector for carbon dioxide, have been ordered.

The second experimental project concerns measurement of

solubilities of heavy hydrocarbons in compressed gases. Components for this experimental project have been designed and are now under construction. Heavy hydrocarbon chemicals have been ordered.

Contacts have been established with industry and other research laboratories toward obtaining real-tar samples for use in the last stages of this project. The following have indicated willingness to send us tar samples:

Riley Stoker Co. (Worcester, Mass.)  
Institute of Gas Technology (Chicago, Illinois)  
Pittsburgh Energy Research Center (Bruceton, Penn.)  
Morgantown Energy Research Center (Morgantown, W. Va.)  
Lawrence Laboratory (Livermore, California)  
Laramie Energy Research Center (Laramie, Wyo.)

The rate of progress is consistent with that specified in the work plan.

### Conclusions

At this early stage no technical conclusions can be expected. The project has been initiated as anticipated, progress is on schedule and no unusual or unexpected difficulties have been encountered.

### Literature Cited

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- (3) A. Berthoud, Ann. Chim. Phys. 11 580 (1913).
- (4) G. C. Sinke, J. Chem. Thermodynamics 6 311 (1974).