Some variation in these observations will occur depending upon the precise geometry of the copper coils, the proximity to the ammonia solution, and the concentration of the solution. The observations in Table 1 refer to fresh solution.

By now, an observer will have noticed a number of local changes in temperature on the surface of the copper coils. These take the form of the occasional flickering of the colour of the surface, sometimes in response to movement of the coil, at other times apparently in response to convection within the flask. Without pursuing the exact cause of these fluctuations, one may observe that the temperature colour changes are fairly large, and that they occur swiftly across the surface of the catalyst wire, despite its thermal inertia. This observation illustrates that transient temperatures are easily produced in catalyst particles with exothermic reactions.

Finally, questions that should be asked of students watching this demonstration include:

- What observations make it clear that the (pseudo) steady state reaction is heat transfer rather than mass transfer controlled?
- Estimate from the colour of the wire (or its melting point) a temperature difference across the gas film.
- Why does the thinner No. 24 wire become hotter than the thicker No. 18 wire? In your answer include the effects of radiation as well as conduction along the wire.
- Is conduction responsible for the gradual loss of glow in No. 12 wire? An experimental answer may be easiest here by cutting the helix off the No. 12 wire sample, and holding it by a thin wire (say No. 22 copper), heating to incandescence, and placing it in the flask.
- Explain by means of a diagram the return of the wire to its former temperature after withdrawal from and replacement in the flask. □

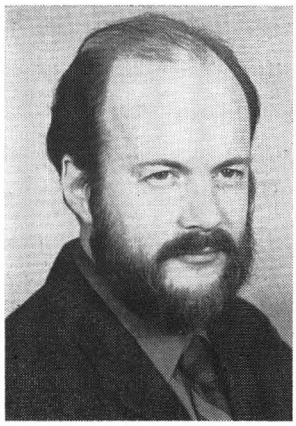

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TABLE 1
Typical Stability Observations

Wire gauge No. (AWG)	Diameter (in.)	Diameter (cm.)	Observations
12	0.081	0.21	Bright glow on entering flask gradually fades to extinction. Stability demonstration not possible.
18	0.040	0.10	Glow readily stabilizes at bright yellow-orange; when small temperature perturbation is introduced, glow slowly recovers to original colour; large perturbation of temperature extinguishes glow.
24	0.020	0.051	Glow can increase to yellow heat, melting wire. Observations similar to No. 18 wire, but with more rapid responses.

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1. G. Fowles, *Lecture Experiments in Chemistry*, 6th Ed., p. 178, G. Bell and Sons Ltd., London 1963.
2. N. Nechamkin and J. J. McClarnon, p. 169, 1960 Reprint Edition of "Tested Demonstrations", *J. Chem, Educ.*, H. N. Alyea, (editor).

ChE book reviews

Introduction to Control Systems

By D. K. Anand
Pergamon Press, Inc. 1974
Reviewed by Doug Wilde, Stanford University

This text is interchangeable with many other books on elementary linear control theory, all of which are good for electrical and mechanical engineers, and none of which deal with chemical engineering systems. There are books much more suitable for courses taught exclusively to chemical engineering students. Still other books would be better for a general control course mixing chemical with mechanical and electrical engineering students. This book would be appropriate only for a general control course not catering to chemical engineering students at all, and it is little different from earlier texts written for the same purpose. □