

## Perchlorate Salts of Metal Ion Complexes: Potential Explosives

The recent article describing the use of  $[\text{Cu}(\text{tmen})(\text{acac})]\text{ClO}_4$  as a color indicator for solvent parameters (1) fails to identify the potential danger associated with the preparation and handling of this salt. Most of us are aware that "organic perchlorates are self-contained explosives" (2). However, many overlook the fact that a perchlorate salt of a cation, such as a complex ion that contains an organic group or other oxidizable atoms, is also an explosive (although the conditions required to initiate an explosion vary from sample to sample). For example, one sample of  $\text{Co}(\text{H}_2\text{O})_3(\text{ClO}_4)_2$  detonated under a slight impact while attempts to repeat the detonation with other samples were not successful (3). Such compounds must be handled with great care (4), if at all.

The coordination chemist's grapevine is replete with stories of perchlorate explosions, most recently the explosion of a preparation of about 3 g of a perchlorate salt of a rhodium polyamine complex that detonated in a rotary evaporator over a hot water bath. This violent explosion destroyed the evaporator, smashed a lab jack, cracked the bench top, and chipped walls over 15 ft away. Fortunately, this happened in an empty lab. Explosions of other perchlorate salts of complex ions have resulted in serious injuries (5-7).

Testing a perchlorate for sensitivity may not be reliable. A recent letter (8) described the detonation of a perchlorate adduct of polyacetylene that previous tests suggested was relatively stable. Impurities and changes in crystalline type, habit, or size can have profound effects on the sensitivity of an explosive (9).

One solution to the problem of dealing with these explosive salts lies in replacing the perchlorate ion with a nonoxidizing ion. The ready availability of tetrafluoroborate salts and tetrafluoroboric acid,  $\text{HBF}_4$ , and the charge and size compatibility of  $\text{BF}_4^-$  and  $\text{ClO}_4^-$  suggest that tetrafluoroborate salts make excellent substitutes.

### Literature Cited

- (1) Soukup, R. W., and Schmidt, R., *J. CHEM. EDUC.*, **62**, 459 (1985).
- (2) Bretherick, L., (Editor), "Hazards in the Chemical Laboratory," Royal Society of London, London, 1981, p. 431.
- (3) Cook, R. E., and Robinson, P. J., *J. Chem. Res.*, (S) 267, (M) 2772 (1982).
- (4) Schilt, A. A., "Perchloric Acid and Perchlorates," The G. Frederick Smith Chemical Co., Columbus, Ohio, 1979.
- (5) Wolsey, W. C., *J. CHEM. EDUC.*, **50**, A335 (1973).
- (6) Pennington, D. E., *Chem. and Eng. News.*, 55 (August 16, 1982).
- (7) Raymond, K. N., *Chem. and Eng. News.*, 4 (December 5, 1983).
- (8) Eisenbaumer, R. L. and Miller, G. G., *Chem. and Eng. News.*, 4 (June 3, 1985).
- (9) Olander, D. E., *Chem. and Eng. News.*, 2 (March 5, 1984).

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