

A REVERSIBLE OXIDATION INDICATOR OF HIGH POTENTIAL  
ESPECIALLY ADAPTED TO OXIDIMETRIC TITRATIONS

Sir:

We have found that the ferrous-ortho-phenanthroline complex ion discovered by Blau [*Monatsh.*, **19**, 647 (1898)] may be used as a reversible oxidation indicator of high potential and is ideally suited for many oxidimetric titrations. It is of an intense red color, which oxidation to the ferric complex converts to a blue of less intensity. Once formed by reaction of phenanthroline and ferrous sulfate in aqueous solution, the complex is not appreciably decomposed in several hours at room temperature by strong acids, although these do prevent its formation. The ferric complex is resistant to acids and to the action of permanganate, dichromate or ceric ions in acid solution. By electrometric titration with ceric sulfate we have found the indicator system to be of high mobility and perfect reversibility and to have a molar potential of 1.14 volts. It may, therefore, be used for any titration of an active reducing agent with ceric sulfate in the cold. This valuable and extremely stable oxidizing agent has been available for titrations hitherto only by the use of an electrometric end-point or of an indicator of potential not really suited to the titration and susceptible to side reactions and decompositions. We have found that high precision may be attained in the titration of ferrous ion and ceric ion when the amount of indicator used has an oxidation equivalent of 0.01 cc. of 0.1 normal solution. We have furthermore found that a similar precision may be obtained in titrations of ferrous ion and dichromate ion in sulfuric or hydrochloric acid solution, and that the above-named quantity of indicator gives an entirely satisfactory end-point in spite of the color of the chromic and ferric compounds. When titrating dichromate with ferrous salt the color change is instantaneous; in the reverse titration it is necessary to wait for a few seconds after each addition when near the end-point. The standardization of a ferrous sulfate solution against purified potassium dichromate using this indicator agrees excellently with that obtained against sodium oxalate by way of permanganate. The use of this valuable ultimate standard in oxidimetry is thus made simpler than previously possible. The presence of other common metallic ions, including notably mercuric ion, was not found to affect the precision of ferrous-dichromate titrations. The ferrous-dipyridyl complex was found to be a less satisfactory indicator because of its more rapid reaction with acids.

We are continuing the investigation of the application of this and similar compounds to oxidimetric titrations and expect soon to report full details.

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