

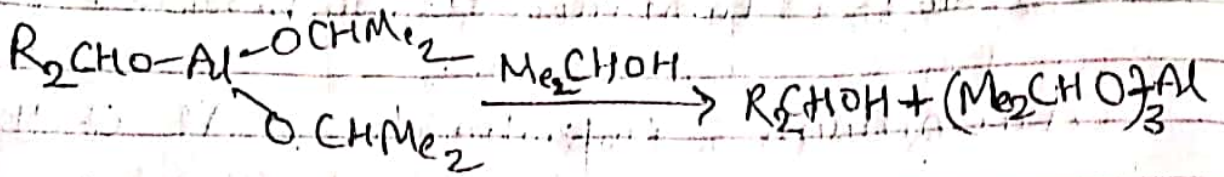
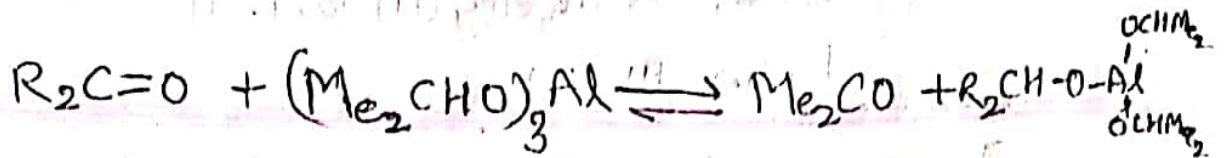
Topic:- Aluminium isopropoxide - (Reagent)

Aluminium isopropoxide  $\text{Al} \begin{array}{l} \text{O-CH-CH}_3 \\ \text{CH}_3 \end{array}$

**Preparation:** → The reagent is prepared by refluxing anhydrous isopropyl alcohol with aluminium amalgam in the presence of a small amount of carbon tetrachloride ( $\text{CCl}_4$ ) as catalyst. After the evolution of hydrogen, the mixture is distilled under reduced pressure when aluminium isopropoxide distils over at  $140-150^\circ\text{C}$  (12 mm) as a colourless liquid.

**Uses:** → Aluminium isopropoxide is a good reducing agent. It reduces by transfer of hydride ions. It is a specific reducing agent for the reduction of carbonyl compounds to alcohols without affecting other sensitive reducible groups. With excess of the reagent at elevated temperature, diaryl ketones may be reduced to hydrocarbons.

The reduction is carried out by heating the carbonyl compound with the reagent in isopropyl alcohol and distilling off the acetone as it is formed.

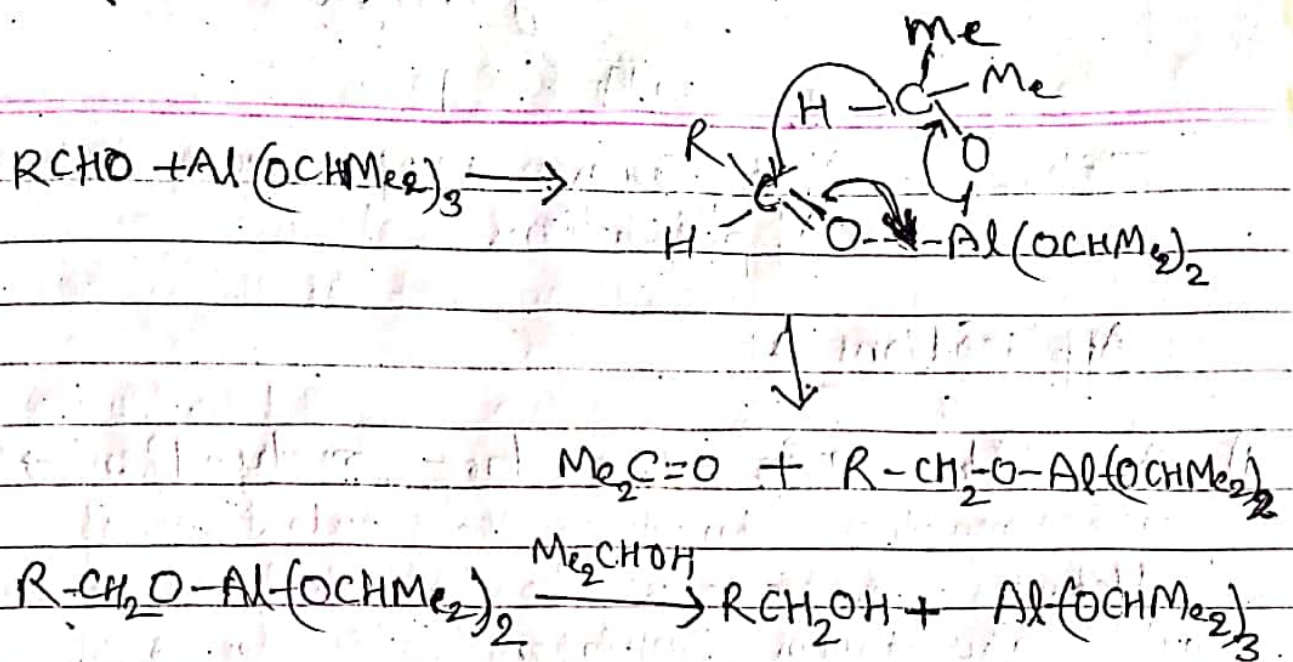


Since the reaction is reversible, the reagent can also be employed for the oxidation of alcohols. The reverse reaction is known as Oppenauer oxidation. The position of equilibrium can be controlled by the amount of acetone present. The equilibrium shifts forward on distilling out the acetone as it is formed. An excess of acetone favours oxidation (reverse reaction).

The reagent is better than other metallic alkoxide because it is relatively less polar. The aluminium-oxygen bond is almost covalent and does not give alkoxide ions which generally cause much condensation of carbonyl compounds.

### Mechanism:

The reaction proceeds by complexing the carbonyl oxygen of the substrate in the cyclic transition state, resulting in the formation of an alkoxide.



Metal alkoxides undergo rapid acid-base exchange with their corresponding alcohols. Hence an excess of isopropyl alcohol is used so that it exchanges with the mixed alkoxide to liberate the reduced aldehyde or the desired alcohol. Hence, the hydrogens for the reduction are supplied one each by the catalyst and the solvent.

A hydride ion is transferred from the reagent to the carbonyl compound is proved by the fact that with  $(\text{Me}_2\text{CDO})_3\text{Al}$ , the carbonyl compound gave  $\text{RCHD}(\text{OH})$ . This indicates that the reaction proceeds via the cyclic transition state.