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# 3

## Composition and Chemistry

The composition and chemistry of the alkaline-manganese dioxide cells described in Sections 3.1 through 3.4 are typical for all alkaline products.

### 3.1 Active Components

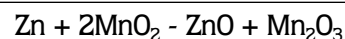
The chemically active components are:

**Anode:** High purity zinc powder

**Cathode:** Electrolytically produced manganese dioxide

**Electrolyte:** Concentrated potassium hydroxide solution

During cell discharge, the oxygen-rich manganese dioxide is reduced and the zinc becomes oxidized, while ions are being transported through conductive alkaline electrolyte. The simplified cell reaction is:



### 3.2 Anode

The anode material of the alkaline cell is a powdered zinc metal. Manufacturing of the zinc powder is carefully controlled to ensure chemical purity and correct particle size, resulting in good surface area available during the cell reaction. This increased surface area provides greater particle to particle contact within the anode, thereby lowering the cell's internal

resistance, generating higher power density.

Keeping pace with regulatory requirements worldwide, environmentally responsive anode designs have been implemented by Duracell. Contact your local Duracell sales representative for the latest information on these designs.

### 3.3 Cathode

The cathode material of the cell is a powdered manganese dioxide ( $\text{MnO}_2$ ), produced synthetically through an electrolytic process. Its purity and oxygen availability are far superior to the natural material. This contributes to the cell's increased energy density and performance.

Additives are used in the major cathode components to enhance performance capability. For example,

graphite is mixed with the manganese dioxide to improve conductivity. When mixed with the other ingredients, the electrolytic manganese dioxide provides a cathode of excellent conductivity to assure good cell performance over a wide range of temperatures and discharge rates.

### 3.4 Electrolyte

The electrolyte consists of a concentrated aqueous solution of potassium hydroxide (KOH) to which zinc oxide is added to retard corrosion of the zinc. This inhibits the dissolution of the zinc anode and extends the shelf life. In some cell designs, a gel-type electrolyte is formed by the addition of a gelling agent.

This electrolyte is alkaline (basic) in contrast to the electrolyte of regular zinc-carbon cells, which is acidic. The concentrated potassium hydroxide solution offers high ionic mobility with a low freezing point.