



Mobile  
Energy

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# SPECIALTY CARBONS FOR ALKALINE BATTERIES

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**TIMREX<sup>®</sup>**  
TIMCAL Graphite

**TIMREX<sup>®</sup>**  
TIMCAL Dispersion

[imerys-graphite-and-carbon.com](http://imerys-graphite-and-carbon.com)

# Imerys Graphite & Carbon

## WHO ARE WE?

Imerys Graphite & Carbon has a strong tradition and history in carbon manufacturing. Its first manufacturing operation was founded in 1908. Today, Imerys Graphite & Carbon facilities produce and market a large variety of synthetic and natural graphite powders, conductive carbon blacks and water-based dispersions of consistent high quality. Adhering to a philosophy of Total Quality Management and continuous process improvement, all Imerys Graphite & Carbon manufacturing plants comply with ISO 9001:2008. Imerys Graphite & Carbon is committed to produce highly specialized graphite and carbon materials for today's and tomorrow's customers needs. Imerys Graphite & Carbon belongs to Imerys, the world leader in mineral-based specialties for industry.

## WHERE ARE WE LOCATED?

With headquarters located in Switzerland, Imerys Graphite & Carbon has an international presence with production facilities and commercial offices located in key markets around the globe. The Group's industrial and commercial activities are managed by an experienced multinational team of more than 430 employees from many countries on three continents.

For the updated list of commercial offices and distributors please visit [www.imerys-graphite-and-carbon.com](http://www.imerys-graphite-and-carbon.com)



**Lac-des-Îles, Canada**  
Mining, purification and sieving of natural graphite flakes



**HQ Bodio, Switzerland**  
Graphitization and processing of synthetic graphite, manufacturing of water-based dispersions, processing of natural graphite and coke, and manufacturing and processing of silicon carbide



**Changzhou, China**  
Manufacturing of descaling agents and processing of natural graphite



**Terrebonne, Canada**  
Exfoliation of natural graphite, processing of natural and synthetic graphite



**Willebroek, Belgium**  
Manufacturing and processing of conductive carbon black



**Fuji, Japan**  
Manufacturing of water-based dispersions

## WHAT IS OUR MISSION?

To promote our economic, social and cultural advancement with enthusiasm, efficiency and dynamism by offering value, reliability and quality to ensure the lasting success of our customers.

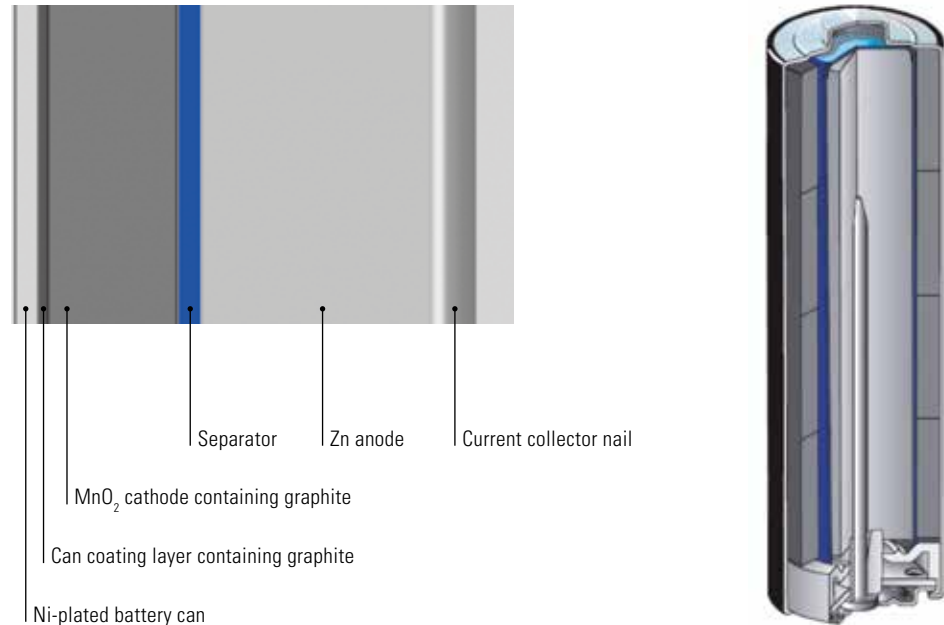
## WHAT IS OUR VISION?

To be the worldwide leader and to be recognized as the reference for innovative capability in the field of carbon powder-based solutions.

# TIMREX® graphite solutions for alkaline batteries

## TIMREX® PRODUCTS IN THE ALKALINE BATTERY

To improve the performance of the battery, manufacturers tend to decrease the internal resistivity of the cell. In this respect, a perfect control of the resistivity of the cathode mix as well as of the resistivity of the interface between the cathode and the steel can of the battery is essential.



### TIMREX® GRAPHITE POWDERS

#### High performance conductive additives for EMD cathode rings

Imerys Graphite & Carbon's graphite additives offer a consistence of quality, optimized texture and some unique properties due to clearly specified, high level purity and crystallinity.

### TIMREX® GRAPHITE DISPERSIONS

#### Low VOC, electrically conductive dispersions for battery can coatings

For high quality batteries with high energy and power density, especially when high current drain is a must, TIMREX® environmental friendly aqueous graphite dispersions are applied by leading producers to coat the inner surface of the battery can.

# TIMREX<sup>®</sup> graphite solutions for alkaline batteries

## TIMREX<sup>®</sup> KS GRADES – THE CLASSIC FAMILY

Imerys Graphite & Carbon's leading role in the field of electrochemical applications for synthetic graphite started in the mid seventies of the last century. With the introduction of TIMREX<sup>®</sup> KS44 Imerys Graphite & Carbon made it possible for battery manufacturers to avoid the addition of mercury in the alkaline Zn/MnO<sub>2</sub> battery.

Still today, TIMREX<sup>®</sup> KS graphite powders are widely used as conductive additives in alkaline battery cathodes.

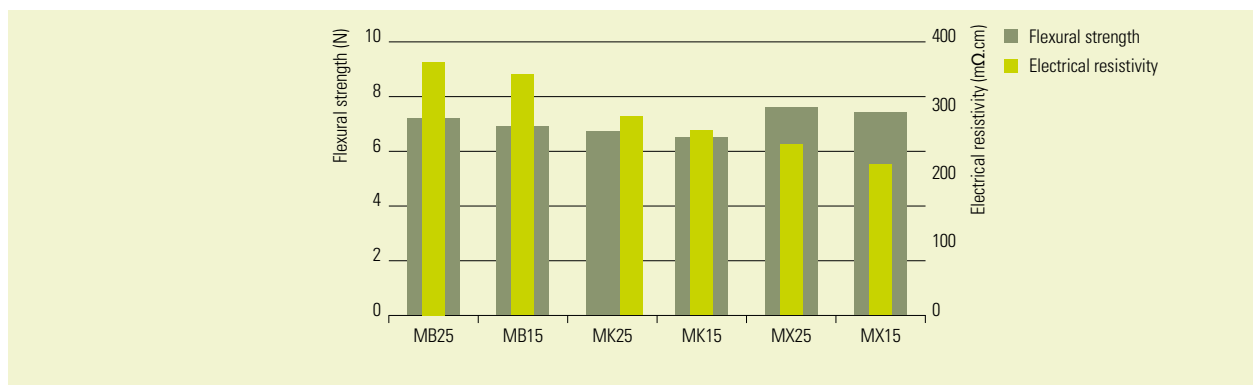
In TIMREX<sup>®</sup> KS grades small, highly crystallized graphite crystals agglomerate in the graphite particles. This leads to the intrinsic electrical conductivity, which allows the use of these grades as conductive additives in a cathode blend. The specific particle texture and porosity of TIMREX<sup>®</sup> KS graphites cause high electrolyte absorption capacity, ensuring an optimum electrolyte penetration in the electrode as well as an ideal ionic contact of the EMD particles. The isometric particle shape ensures good processability.

## TIMREX<sup>®</sup> MB, MK, MX, KC GRADES – THE IMPROVED FAMILIES

The increasing demand for new alkaline batteries with high energy and power density for the market segment in the high current drain regime led the battery manufacturers to increase the EMD/graphite ratio in the cathode.

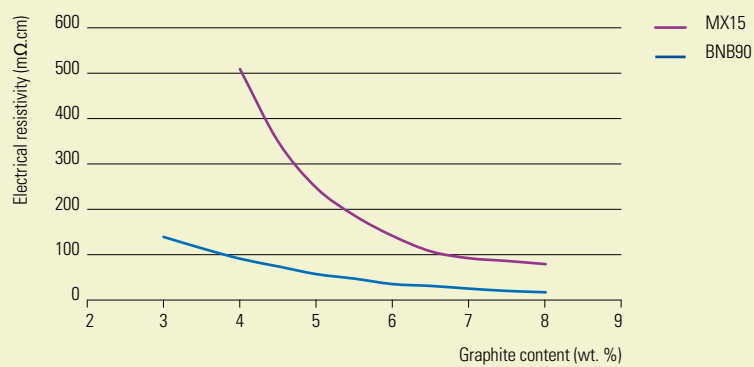
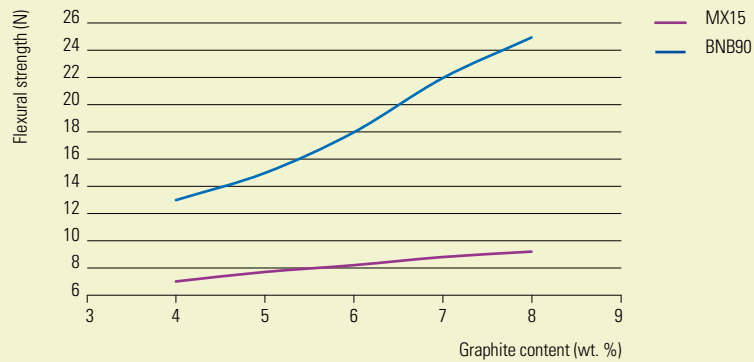
TIMREX<sup>®</sup> MB, MK, MX and KC are improved graphite materials to be used as conductive additives in alkaline battery cathodes with a high EMD/graphite ratio. Combining the best electrochemical properties with excellent processability at a reasonable price has been the intention of our researchers while designing and developing these grades.

TIMREX<sup>®</sup> improved grades are high crystalline flake graphites with an extreme anisotropic character. Their particle shape provides the ideal electrical conducting matrix in the cathode. They show their advantage in electrochemical performance compared to other graphite grades particularly at low graphite contents in the cathode in the high current drain regime. Optimized compressibility, excellent lubricating properties minimizing tool wear, excellent processability and workability are granted by these grade's texture, morphology as well as by their high crystalline flake-type character and shape. TIMREX<sup>®</sup> improved grades are the best performing, non-expanded graphite for alkaline batteries, thus providing an attractive price/performance ratio when compared to expanded graphites. They offer an optimal balance between electrochemical performance, processability and battery manufacturing cost.



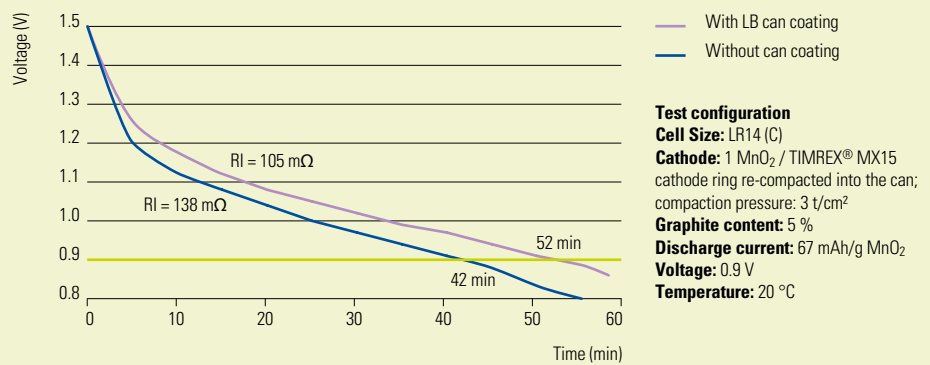
## TIMREX<sup>®</sup> B GRADES – THE BEST PERFORMER

TIMREX<sup>®</sup> B grades have been designed for cathodes with low graphite content. TIMREX<sup>®</sup> B grades are high-purity expanded graphites, manufactured in a sophisticated process, internally developed by Imerys Graphite & Carbon. The extreme two-dimensional particle shape of these grades ensures a very high electrical conductivity in the cathode mix with very low percolation thresholds. Their unique texture and powder morphology particularly improve compression and binding properties. The particular morphology allows a higher bulk density and ideal blending properties with other components of the cathode. TIMREX<sup>®</sup> BNB90 provides an excellent electrochemical performance combined with high mechanical stability of the cathode rings even at very low graphite content levels in the cathode blend. At these high EMD/graphite ratios the cathode reveals still sufficiently high electrical conductivity, thus allowing a high energy density of the battery in the high current regime.



**TIMREX® LB COATING DISPERSIONS – BOOSTING THE CELL PERFORMANCE**

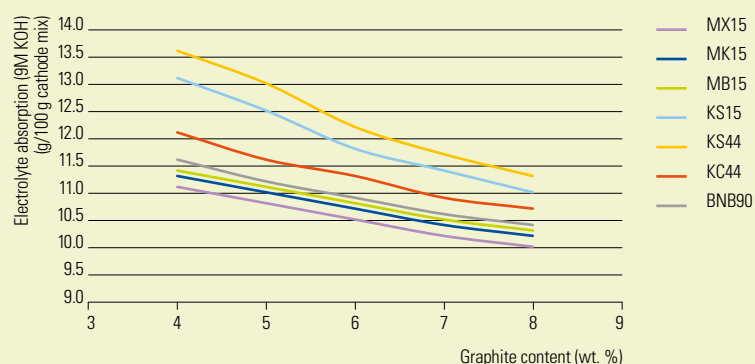
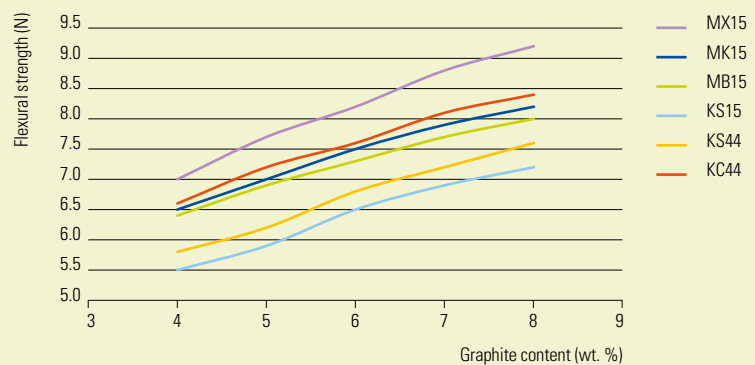
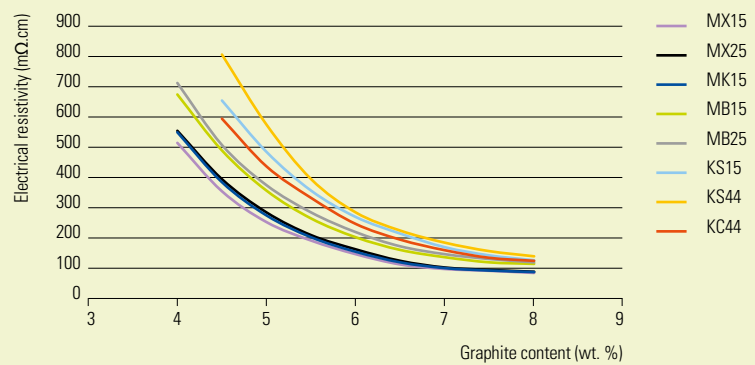
TIMREX® LB grades are low VOC, aqueous dispersions containing very fine graphite powders. Applied either by spraying, dip-coating or brush-painting, they form a thin, electrically conductive layer, which shows chemical inertness and good adhesion on specific substrates. By coating the nickel- or cobalt-plated steel can, a much lower cell resistance may be achieved, also combined with a higher discharge capacity of the alkaline battery.



# TIMREX® graphite solutions for alkaline batteries

## ADDITIONAL PERFORMANCE DATA

TIMREX® graphite conductive additives significantly decrease the resistivity of the EMD cathode ring. While using the same graphite grade, the electrical resistivity is decreased by an increase of the graphite content in the cathode mass and by applying higher compaction pressure. The performance of the individual graphite as conductive additive can be detected especially at low graphite contents. In this graphite concentration regime only specially optimized graphites, expressly dedicated for high energy density batteries can be used. A good mechanical strength of the cathode is one of the key factors in battery technology, as it determines processability and production efficiency. Generally speaking, it may be assumed, that with the same graphite grade the flexural strength can be enhanced by increasing the graphite content and the compaction pressure. Specially optimized graphites guarantee ideal processability, process efficiency, and tool wear reduction. The electrolyte absorption of the cathode is an important property as the electrochemical charge and discharge performance of a battery is very much depending on the mobility of the ions within the electrodes. Graphite conductive additives influence the electrolyte penetration in the cathode by their own material porosity as well as by controlling the electrode porosity. Tests have evidenced the fact that the electrolyte absorption is influenced not only by the compaction pressure but also by the nature and particle size of the graphite material. Applying high compaction pressures and small average particle sizes diminish the electrode porosity and therefore the electrolyte absorption.



# Product recommendation

## Application-related properties of TIMREX® graphite conductive additives and can-coating dispersions

GRAPHITE GRADE	PARTICLE SIZE, D90 (µm)	PARTICLE SHAPE	ASH (%)	SCOTT DENSITY (g/cm <sup>3</sup> )	SPECIFIC BET (m <sup>2</sup> /g)	RECOMMENDED GRAPHITE CONCENTRATION	BATTERY TYPE
KS15	17	isometric, irregular spheroids	0.05	0.10	12	7 – 9 %	Standard AA, AAA, button cells
KS44	45	isometric, irregular spheroids	0.06	0.19	9	7 – 9 %	Standard AA, AAA, C, D
KC44	48	isometric, irregular spheroids	0.05	0.19	7	6 – 8 %	High-drain C, D
MB15	18	anisometric, flakes	0.06	0.09	9.5	6 – 7 %	High-drain AA, AAA
MB25	27	anisometric, flakes	0.06	0.11	8	6 – 7 %	High-drain AA, AAA, C, D
MK15	15	strongly anisometric, flakes	0.03	0.07	10	5 – 6%	High-drain AA, AAA
MK25	22	strongly anisometric, flakes	0.03	0.09	8	5 – 6%	High-drain AA, AAA
MK44	42	strongly anisometric, flakes	0.03	0.12	6	6 – 7%	High-drain C, D
MX15	17	strongly anisometric, flakes	0.05	0.065	9.5	4 – 6 %	High-drain AA, AAA
MX25	25	strongly anisometric, flakes	0.05	0.08	8	4 – 6 %	High-drain AA, AAA
BNB90	85	strongly anisometric, 2-dimensional	0.14	0.03	28	3 – 5 %	High-drain AA, AAA
LB family	Aqueous graphite dispersions						High-drain AA, AAA, C, D

Typical values



## EUROPE

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### Imerys Graphite & Carbon Switzerland Ltd.

Group Head Office • Strada Industriale 12 • 6743 Bodio • Switzerland  
Tel: +41 91 873 20 10 • Fax: +41 91 873 20 19 • [graphiteandcarbon.ch@imerys.com](mailto:graphiteandcarbon.ch@imerys.com)

### Imerys Graphite & Carbon Belgium SA

Brownfieldlaan 19 • 2830 Willebroek • Belgium  
Tel: +32 3 886 71 81 • Fax: +32 3 886 47 73 • [graphiteandcarbon.be@imerys.com](mailto:graphiteandcarbon.be@imerys.com)

### Imerys Graphite & Carbon Germany GmbH

Berliner Allee 47 • 40212 Düsseldorf • Germany  
Tel: +49 211 130 66 70 • Fax: +49 211 130 667 13 • [graphiteandcarbon.de@imerys.com](mailto:graphiteandcarbon.de@imerys.com)

### France Representative Office c/o Imerys

154-156 rue de l'Université • 75007 Paris • France  
Tel: +33 1 495 565 90/91 • Fax: +33 1 495 565 95 • [graphiteandcarbon.fr@imerys.com](mailto:graphiteandcarbon.fr@imerys.com)

### UK Representative Office

Tel: +44 1 270 212 263 • Fax: +44 1 270 212 263 • [graphiteandcarbon.uk@imerys.com](mailto:graphiteandcarbon.uk@imerys.com)

## ASIA-PACIFIC

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### Imerys Graphite & Carbon Japan K.K.

Tokyo Club Building 13F • 3-2-6 Kasumigaseki • Chiyoda-ku • Tokyo 100-0013 • Japan  
Tel: +81 3 551 032 50 • Fax: +81 3 551 032 51 • [graphiteandcarbon.jp@imerys.com](mailto:graphiteandcarbon.jp@imerys.com)

### Imerys Graphite & Carbon (Changzhou) Co. Ltd.

188# Taishan Road • Hi-Tech Zone • Changzhou 213022 • China  
Tel: +86 519 851 008 01 • Fax: +86 519 851 013 22 • [graphiteandcarbon.cn@imerys.com](mailto:graphiteandcarbon.cn@imerys.com)

### Shanghai Branch Office c/o Imerys

288, Jiu Jiang Road • Hong Yi Plaza • Unit 1102-1105 • Shanghai 200001 • China  
Tel: +86 21 613 782 88 • Fax: +86 21 613 780 02 • [graphiteandcarbon.cn@imerys.com](mailto:graphiteandcarbon.cn@imerys.com)

### Singapore Representative Office c/o Imerys Asia Pacific

80 Robinson Road #19-02 • 068898 Singapore  
Tel: +65 67 996 060 • Fax: +65 67 996 061 • [graphiteandcarbon.sg@imerys.com](mailto:graphiteandcarbon.sg@imerys.com)

## AMERICAS

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### Imerys Graphite & Carbon USA Inc.

29299 Clemens Road 1-L • Westlake (OH) 44145 • USA  
Tel: +1 440 871 75 04 • Fax: +1 440 871 60 26 • [graphiteandcarbon.us@imerys.com](mailto:graphiteandcarbon.us@imerys.com)

### Imerys Graphite & Carbon Canada Inc.

990 rue Fernand-Poitras • Terrebonne (QC) J6Y 1V1 • Canada  
Tel: +1 450 622 91 91 • Fax: +1 450 622 86 92 • [graphiteandcarbon.ca@imerys.com](mailto:graphiteandcarbon.ca@imerys.com)

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