

PRINTEX® kappa 100

Conductive carbon black for lithium-ion batteries

Datasheet

Orion Engineered Carbons is a global leading manufacturer of carbon black, with more than 150 years of experience in the carbon black industry. With 14 global production sites and four applied technology centers, Orion focuses on technological innovation and customer needs. Orion offers the broadest portfolio of carbon black products for standard and high-performance applications like rubber, polymers, coatings, printing and energy storage, among others.

PRINTEX® kappa 100 is the high performance acetylene black from Orion for lithium-ion batteries. Produced by the exothermic decomposition of acetylene gas, PRINTEX® kappa 100 shows the lowest CO₂ emission among high conductive carbon black grades. Properties such as high thermal and electrical conductivity, high purity, low moisture content and high chemical stability, make PRINTEX® kappa 100 the conductive additive of choice when high-energy density or high-power density are required.

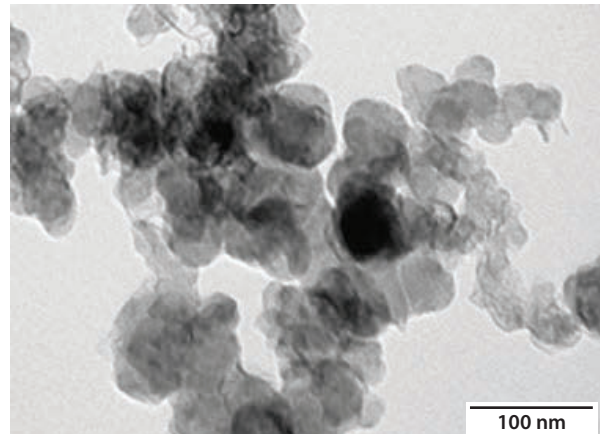
Table 1
Typical values

| PRINTEX® kappa 100 | Unit | Value |
|--------------------|-------------------|-------|
| BET | m ² /g | 65 |
| OAN | ml/100 g | 310 |
| Iron content | ppm | 5 |
| Moisture | % | 0.05 |
| Ash content | % | 0.05 |
| Sieve residue 45µm | ppm | 5 |

High conductivity: A high-reaction temperature leads to a high graphitization level of PRINTEX® kappa 100 that imparts high-intrinsic electrical and thermal conductivity. The unique process technology gives PRINTEX® kappa 100 a very high-level long chain network structure in aggregate particles (OAN: 310 ml/100 g), allowing the formation of a conductive network and an easy dispersibility of the carbon black in the slurry after wetting.

Low moisture: Acetylene blacks like PRINTEX® kappa 100 show very low moisture uptake due to high graphitization and very low levels of hydrophilic surface, for easier handling and better battery cycle life.

Figure 1
TEM of PRINTEX® kappa 100

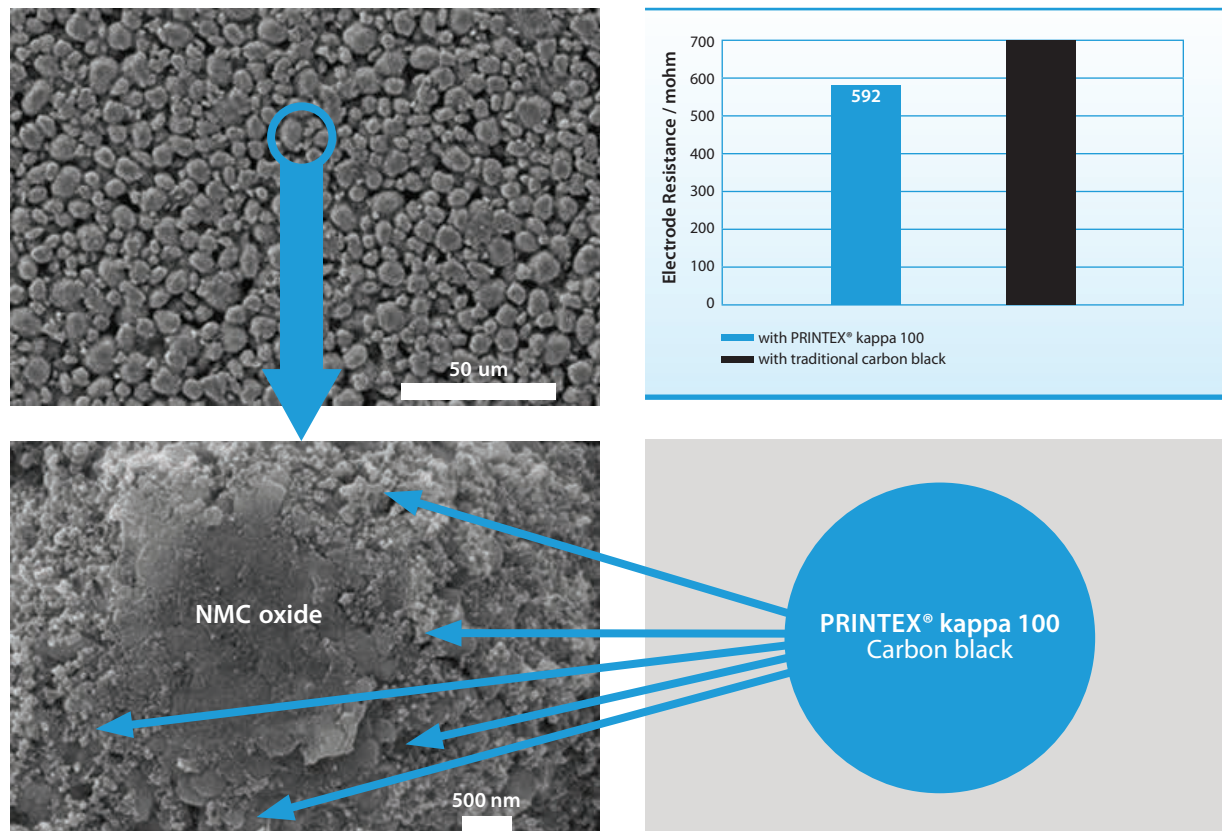


High purity: The clean gaseous feedstock and Orion high quality process control ensures PRINTEX® kappa 100 possesses a very low metal impurity and a very low grit and ash content. The benefit is that the carbon black does not contribute to side reactions, leading to a low self-discharge and long cycle life of the battery.

High chemical stability: PRINTEX® kappa 100 high graphitization level leads to a chemical stability at high voltage operation condition, enabling high energy density of the battery.

PRINTEX® kappa 100 was tested in the cathode electrode, using NMC622 as active material. PRINTEX® kappa 100 provides a good dispersion performance during the electrode preparation, forming a conductive network through all the active material particles. The electrode resistance is lower than in cathode electrodes using traditional carbon black.

Figure 2



Discharge C-rate tests were conducted in 5 Ah pouch cells. The performance of the NMC622 electrode was assessed using 1.5, 2.5 and 3.5 % carbon black. The cells with PRINTEX® kappa 100 show a high capacity retention (84 %) even at 4C discharge rates.

The excellent percolation network and conductivity of PRINTEX® kappa 100 results in similar capacity values even at small carbon loadings, increasing the energy density. Also, PRINTEX® kappa 100 cells show good initial cycling stability.

Figure 3

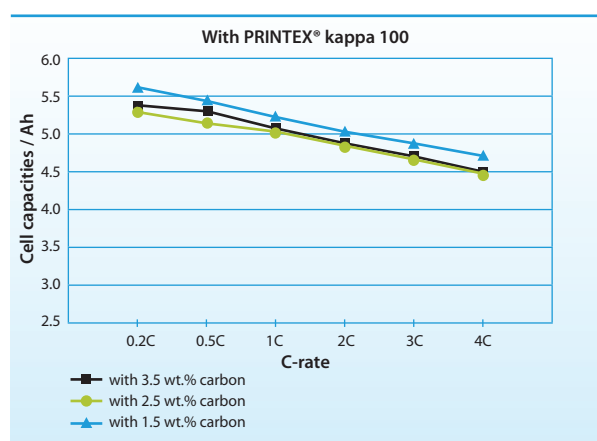


Figure 4

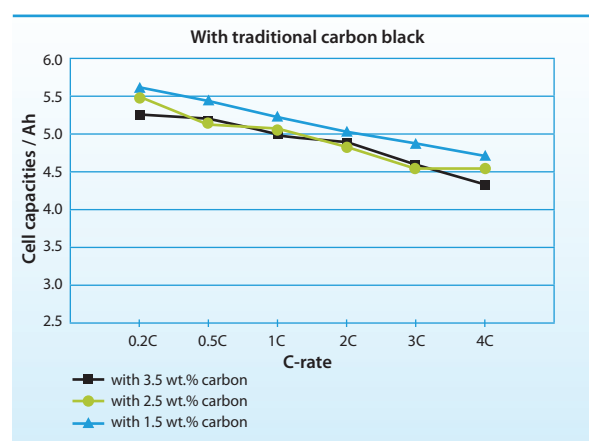
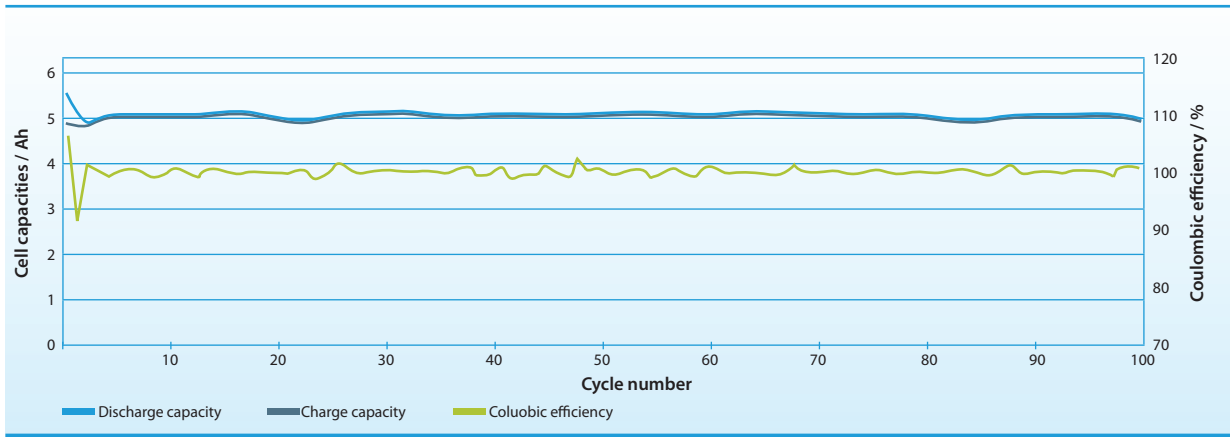


Figure 5



In 2 Ah LCO pouch cells, the high conductivity of PRINTEX® kappa 100 ensures the best charge and discharge response of the cell at high C-rates.

Additionally, the low metal content of PRINTEX® kappa 100 decreases the self-discharge of the battery during storage.

Figure 6

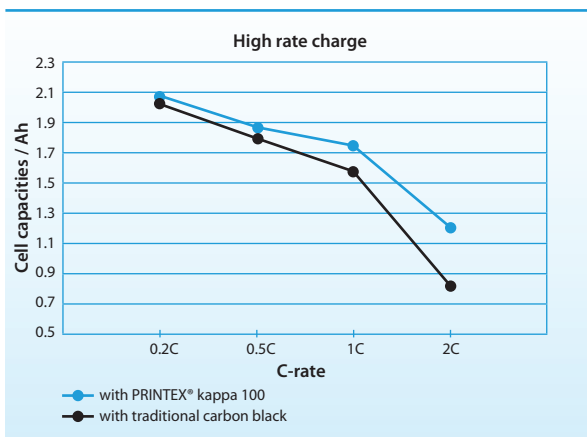


Figure 7

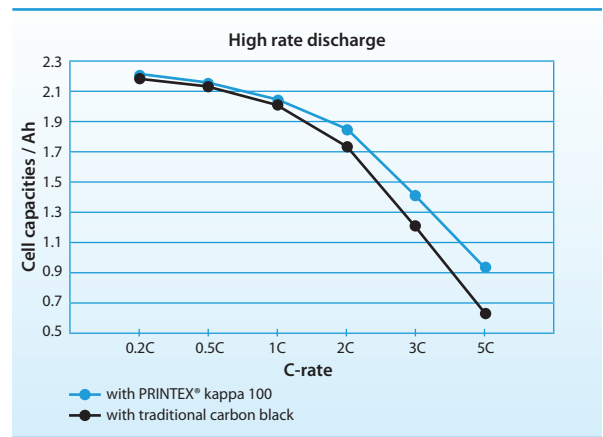
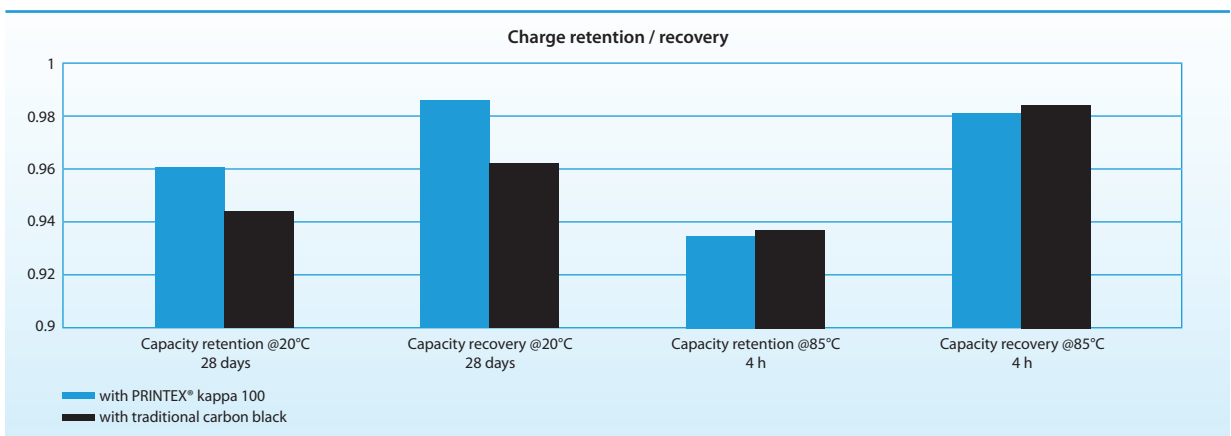


Figure 8



Conductive carbon black is an essential component of the cathode and anode electrodes in lithium ion batteries. Even though the amount of carbon black in the electrode is small, it has an important impact on the electrical conductivity, the safety and the overall performance of the battery.

With the constant development of the lithium-ion battery technology, high-performance conductive carbon black additives will gain more importance. In this context, the wide range of products and the strong know-how of Orion will contribute to the improvement of the current and future lithium-ion batteries.



The Americas

Orion Engineered Carbons LLC
1700 City Plaza Drive, Suite 300
Spring, TX 77389
USA
Phone +1 832 445 3300

AMERICAS@orioncarbons.com

Europe/ Middle East/ Africa

Orion Engineered Carbons GmbH
Hahnstraße 49
60528 Frankfurt am Main
Germany
Phone +49 69 36 50 54 100

EMEA@orioncarbons.com

Asia Pacific

Orion Engineered Carbons (China) Investment Co., Ltd.
Room 3701-3702, BM InterContinental Business Center,
100 Yutong Road
Shanghai 200070, P. R. China
Phone +86 21 61 07 09 66

APAC@orioncarbons.com

Incorporated in Luxembourg

Orion Engineered Carbons S.A., 6 Route de Trèves, L-2633 Senningerberg, Luxembourg, Phone +352 27 04 80 60

www.orioncarbons.com

All statements given by Orion Engineered Carbons GmbH as well as its affiliates, including for example Orion Engineered Carbons S.A. ("Orion") herein are provided for information purposes only and are given as of the date of this document and are based on the knowledge on the date of the document. ORION DOES NOT GIVE ANY REPRESENTATION OR WARRANTY THAT THE CONTENTS OF THE GIVEN STATEMENTS AND INFORMATION ARE CORRECT OR ACCURATE. ANY LIABILITY OF ORION WITH REGARD TO THE CONTENTS PROVIDED ARE HEREBY EXPRESSLY EXCLUDED. Orion does not give a warranty with respect to any results to be obtained from such information, any uses of such information or with regard to the non-infringement of any proprietary right. Nothing stated herein shall be construed as a license of or recommendation for use, especially with concern to the potential infringement of any proprietary right. Use or application of such information or statements or the material or systems described herein are at user's sole discretion and risk. The user acknowledges that Orion shall bear no responsibility or liability for any use or application of such information or statements or the material or systems described herein. All sales are subject to the respective standard terms and conditions of Sale issued by Orion including but not limited to the limitation of liability contained therein. The Orion standard terms and conditions of Sale can be reviewed, downloaded and printed under https://orioncarbons.com/en/general_conditions_of_sale_and_delivery_orion_engineered_carbons_europe_africa.pdf. Any and all information disclosed by Orion herein shall remain the property of Orion.

© 2021 Orion Engineered Carbons GmbH

OEC-Datasheet-10/2021