

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.

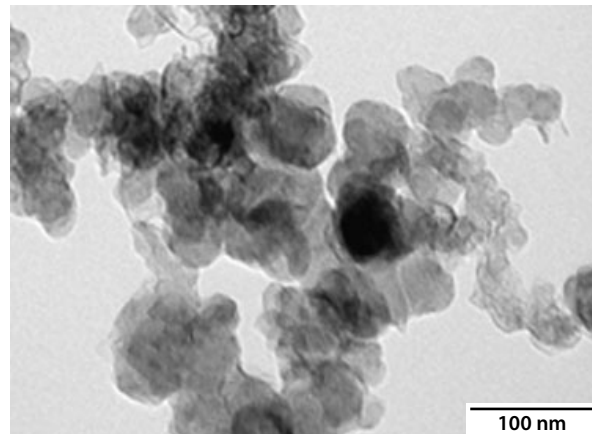
Table 1
Typical values

PRINTEX® kappa 100	UNIT	VALUE
BET	m ² /g	63
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

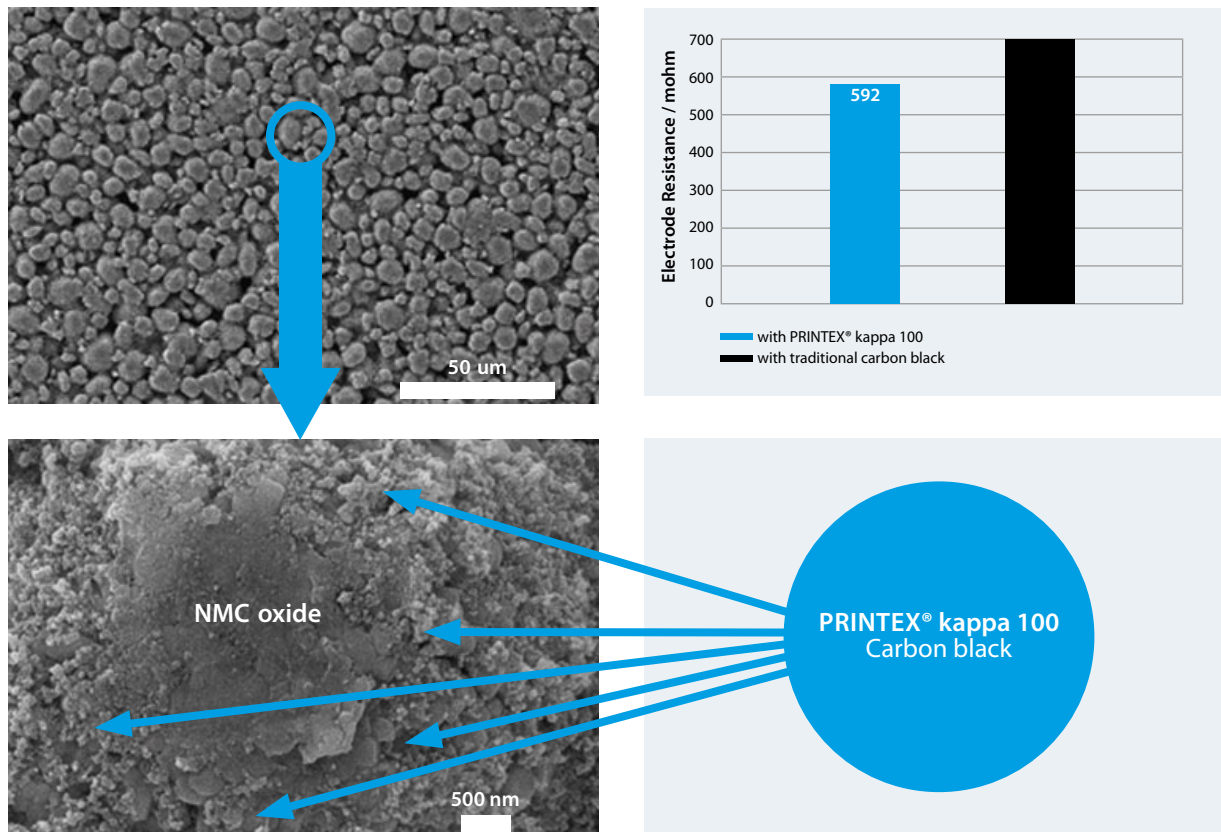


High purity: The clean gaseous feedstock and Orion high quality process control ensures PRINTEX® kappa 100 possesses a very low metal impurity and a very low grit and ash content. The benefit is that the carbon black does not contribute to side reactions, leading to a low self-discharge and long cycle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

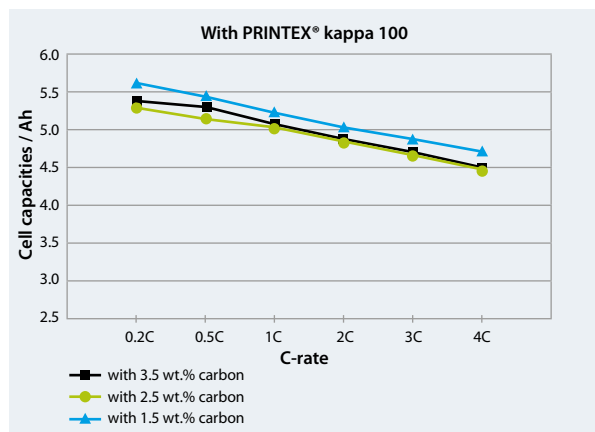


Figure 4

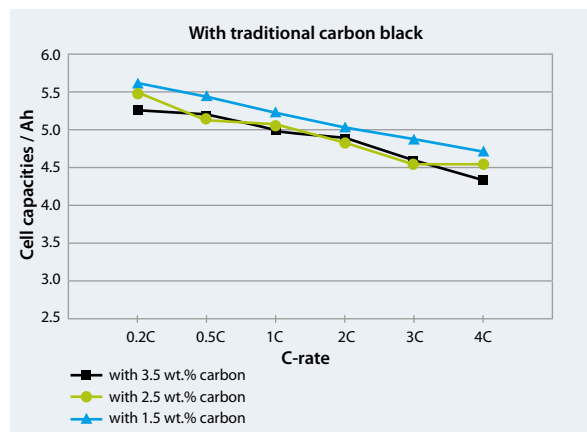
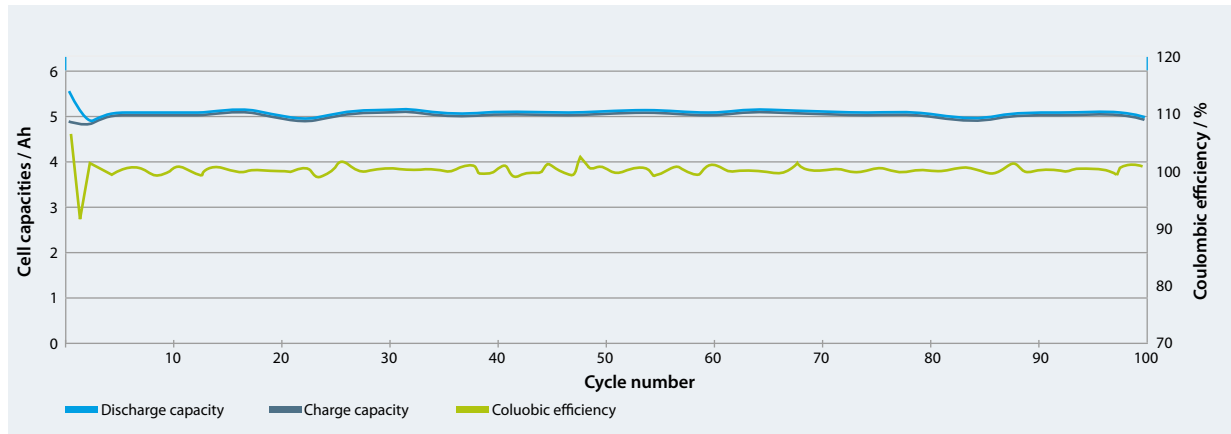


Figure 5



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

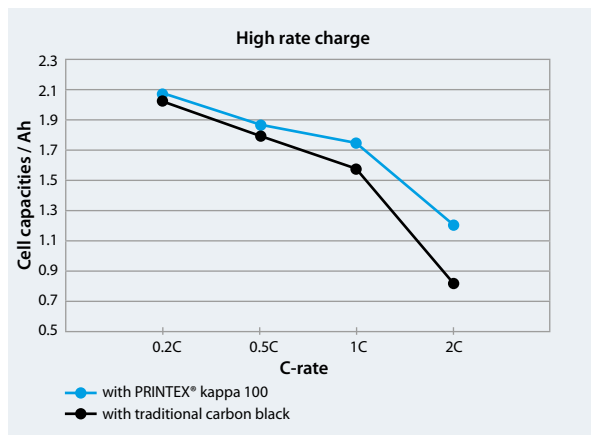


Figure 7

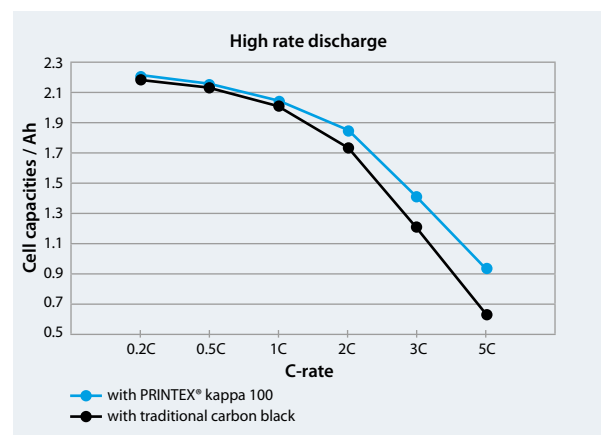
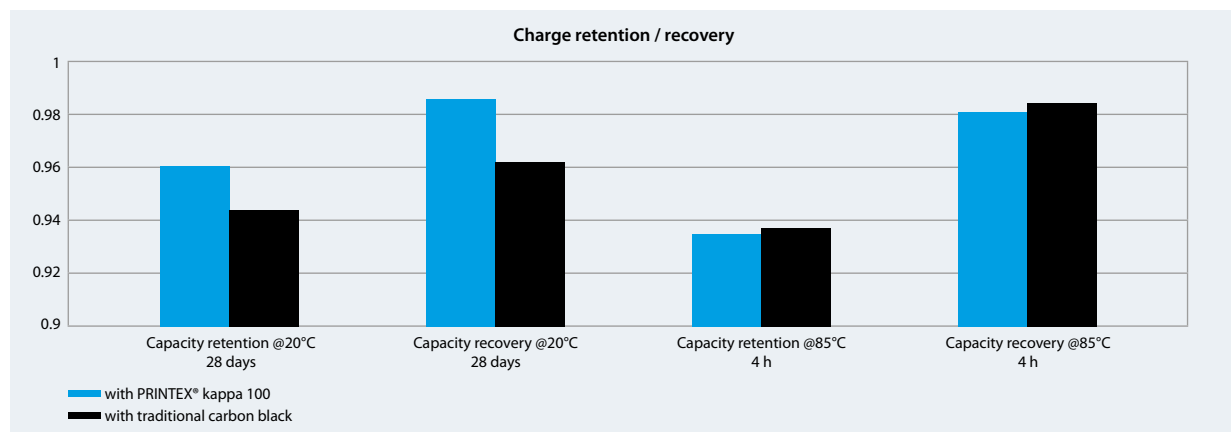


Figure 8



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.

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