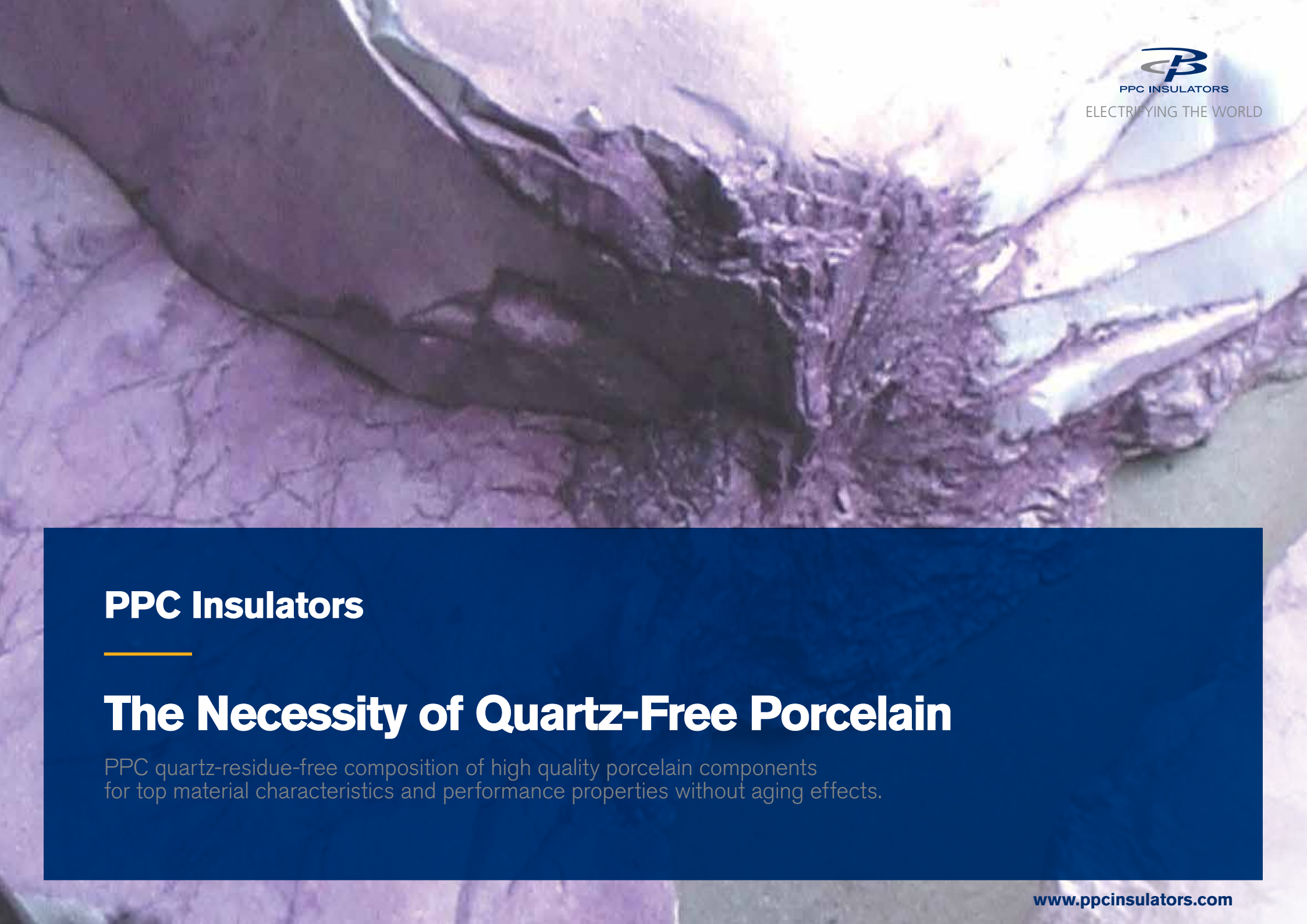


PPC INSULATORS

ELECTRIFYING THE WORLD

PPC Insulators

The Necessity of Quartz-Free Porcelain

PPC quartz-residue-free composition of high quality porcelain components
for top material characteristics and performance properties without aging effects.

Pile of broken insulators at substatio. Photo of Fingrid.

What are the field results with alumina porcelain insulators with high quartz residue?

There have been numerous reports recently from many utilities around the world on failing insulators with serious structural defects appearing only after few years in operation. Major issues with damaging porcelain failures do not occur on only low-cost low-quality insulators but also to highly renowned porcelain brand insulators, many of which have been cutting inspection procedures and quality supervisions. Various studies and testing have unanimously linked these failures to the microcracks and their correlation to quartz residue or quartz particles in the ceramic insulator.

Documenting the failures of porcelain insulators in details, several patterns have been determined, indicating quartz residue as clear root of porcelain insulators failures.

- Most faults occur near top and bottom flanges
- Cracks are detected on the surface before the final breakage
- Presumably at least part of the failures begin inside the insulator

Addressing this crucial issue, many utilities started working on creating a preventive approach to eliminate such failures that drastically effect the lifetime of porcelain insulator and severely reducing their mechanical strength.

PPC Quartz-Free Composition for Lasting Performance

Quartz-residue-free body for full high strength porcelain potential.

PPC Insulators places special emphasis on porcelain material composition as this is the main guarantee for reliable and safe performance without structural deterioration and other rapid aging effects, occurring as a result of high quartz residue after one or two years.

As the insulation industry is rapidly developing and transforming its systems to smarter, fully digitalized substations and grids, one of the main problem and concern on the field remain the insulators as they are the key structural elements of every electrical system. In the quest of delivering the most competitive product and strive for market share, the quality of these products too often plays a secondary role.

C130 Alumina Porcelain

According to standard IEC 60672-3 high strength alumina porcelain (C130) has the highest strength to weight ratio compared to C120 or other defined bodies. However, there are substantial differences in composition and quality of C130 bodies and consequently performance of porcelain insulators available on the market.

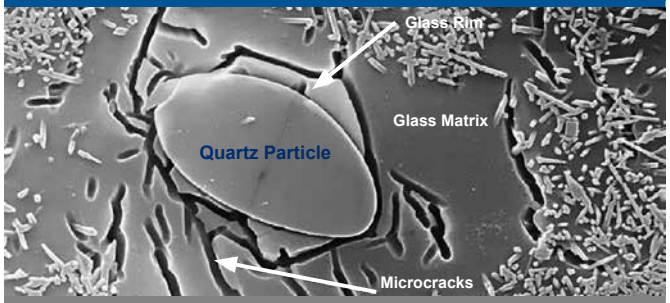
		C110	C111	C112	C120	C130	C140
3-point bending strength, unglazed	σ_{ft} [Mpa]	50	40	80	90	140	50
3-point bending strength, unglazed	σ_{fg} [Mpa]	60	-	100	110	160	60

Quartz Residue and Loss of Mechanical Strength

Similar as to quartz in quartz porcelain (C110-111), quartz residue in high strength alumina porcelain (C130) causes structural microcracks, as a result of natural recrystallization of quartz, which leads to breakage of the insulator.

Although C130 alumina porcelain should not contain quartz, different analysis have proven the presence of quartz residue, either as a result of unclean raw materials with too high Si02 and/or inadequate processing, i.e. firing or cooling. Microcracks and expansion cracks are observed peripheral around quartz particles. Although the value is relatively low, even quartz residue content >1% has a devastating effect on the mechanical strength of alumina porcelain.

Alumina porcelain with high quartz residue degrades rapidly, causing structural deterioration and loss of mechanical strength only after one or two years.



Rashed Adnan Islam, Y.C. Chan, Md. Fakhrul Islam: *Structure–property relationship in high-tension ceramic insulator fired at high temperature*

	Corundum %	Mullite %	Quartz %	Amorphous %
PPC CAB	35	14	< 1	51
PPC EKS	32	11	< 1	57
PPC Santana	34	17	< 1	49
Competitor 1	38	13	2	56
Competitor 2	33	10	1	57
Competitor 3	34	18	>2	47

PPC Porcelain Insulators Guarantee Safe and Longterm Performance

Unlike many porcelain producers, PPC Insulators certifies its porcelain body contains less than 1% of quartz residue, while many other manufacturers continue to produce insulators with quartz residue over 2%.

To ensure the highest quality, transparency and composition control PPC our products, in-house Material Property Test is being performed as part of a standard routine and sample testing. In accordance with IEC standard, PPC Material Property Test is performed separately for the isostatic and plastic method; for both chemical composition analysis, porcelain property test and mineralogy analysis is conducted.

PPC Insulators is a leading manufacturer of porcelain and hybrid insulators for more than 130 years. We invest our efforts to offer quick, easy and effective solutions to our customers. Our extensive knowledge, expertise, and production technology enables us to produce the best insulator designs to cater up to 1,200 kV AC and 1,100 kV DC system voltages, that positions us at the forefront of techno-industrial achievements.

www.ppcinsulators.com

PPC INSULATORS

ELECTRIFYING THE WORLD