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## Microvaristor based field grading elements for HV terminations

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A new elastomeric field grading element is presented, which can be used for nonlinear resistive / refractive field control in MV and HV terminations. The new field control material consists of a polymeric matrix filled with tiny microvaristor particles. This new, functional filler is a spin-off from the well established manufacturing of ZnO arresters. Each filler particle behaves by itself like a microscopically small, highly nonlinear varistor, due to its internal grain boundary structure. By controlled doping and sintering, the electrical properties of these microvaristors can be tailored for specific applications.

Unlike in todays established field control materials, the nonlinear behavior of the filler particles is a pure bulk effect and does not depend on surface or interparticle phenomena, which are poorly understood and difficult to control. This makes the composites much more robust against electrical, thermal and mechanical stresses as well as against processing influences.

Based on the long experience in varistor manufacturing, microvaristors with high nonlinearities extending over a very large current range, low leakage currents and well controlled switching voltages can be realized on large scale.

This allows to design new, cost competitive composite materials with low power losses, high permittivity and excellent impulse performance, as needed for field grading. The basic properties of such new materials will be presented for the case of a flexible silicone matrix.

Since the electrical properties are determined to a large extent only by the properties of the microvaristors, the electrical and mechanical behavior of the composites can be tailored more easily and straightforward to specific needs. This makes new applications possible, which up to now could not be realized.

From detailed electrical and thermal computer simulations, performed at AC and voltage impulses, one can obtain the requirements for the nonlinear field grading material as well as the geometrical and thermal design of the component. The results of such simulations, the tailored materials and the comparison with electrical tests will be discussed for a slim, light weight and easy to install HV cable termination based on the new field grading elements.