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Experimental set-up for measuring the non-linear dielectric effect

Abbreviated title: **NDE equipment**

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Abstract

Simple equipment is described designed to investigate the influence of a strong electric field on the dielectric permittivity of liquids (non-linear dielectric effect, NDE). It is presented the improved method of analyzing the experimental data especially applicable for liquids of heighten conductivity. In test measurements the results obtained for exemplary liquids are compared to the literature data.

Keywords

dielectric permittivity, nonlinear effects, high electric field

1. Introduction

The non-linear dielectric effect (NDE) consists in measuring a change of the electric permittivity under the influence of strong electric field. According to Debye-Langevin theory [1–4] the permittivity for isotropic liquids is a function of electric field strength (E):

$$\varepsilon(E) = \varepsilon_{E \rightarrow 0} + \varepsilon_2 E^2 + \varepsilon_4 E^4 + \dots \quad (1)$$

The measure of the NDE is the so-called Piekara factor $\Delta\varepsilon_{\text{NDE}}/E^2$, where $\Delta\varepsilon_{\text{NDE}}$ is the difference between the electric permittivity measured in strong electric field (of intensity E) and the permittivity

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