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Petroleum products and other liquids — Ethanol — Determination of electrical conductivity

Produits pétroliers et autres liquides — Éthanol — Détermination de la conductivité électrique

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Foreword

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The committee responsible for this document is ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 7, *Liquid biofuels*.

Introduction

Conductivity is related to the electrical current which is achieved by the ions displacement into solution in an electrical field.

The importance of measuring conductivity is due to its role in corrosion processes which can harm metallic components and therefore cause bad engine functioning at long term.

Ethanol can be contaminated with ion solutions in many ways, such as water contamination, chemical treatment in industrial processes, addition of chemical additives, incorrect transportation and storage, generally related to the cleanliness of tanks.

The ascertainment of the conductivity is usually carried out through the measurement of the electrical conductance between two platinum electrodes, immersed in an electrolytic solution and connected to a source of alternating electromotive force of a typical frequency. The resulting current is directly proportional to the number of ions present in the solution, mobility and ionic valence, and temperature.

In the measuring of the conductance, it is essential to use an alternating current in order to eliminate the undesirable effects of faradaic currents. In the case of an alternating resultant current, an inversion of the polarization occurs every half cycle and, consequently, the inversion of the flow of the migration of the ions, leading to a non-faradaic process, which comprises the formation of a double electrical layer in the electrode-solution interface, called double electrical layer, with the potential decreasing linearly in the first part and exponentially in the second part.

In an alternating fashion, the surfaces of the electrodes act as capacitors; the capacitive current increases with the frequency and the size of the electrodes. The control of these variables is in order, so that the alternating current flows preferentially in the form of non-faradaic processes. With an alternating current, there is a reduction of the polarization effect and, as a consequence, an absence of faradaic currents.

In this sense, platinization, that is, covering the surface of the electrodes with a layer of platinum black, increases its surface area significantly and, consequently, its capacitance which causes a reduction in the faradaic current. Further, as a result of the increase in capacitance, there is a reduction in the capacitive reactance, favouring the flow of current in the cell.

For both a metallic or electrolytic conductors, the Ohm Law ($E = I \cdot R$) sets forth that the intensity of the current (I) which passes through an electrical conductor is inversely proportional to the resistance (R), where E represents the difference in potential and the inverse of the resistance is the conductance ($G = 1/R$).Further information is provided in Annex A.