Abstract

In modern electronic systems, memory elements are of fundamental importance for data storage. Especially, solution-processable non-volatile organic memories, which are inexpensive and can be manufactured on flexible substrates, are a promising alternative to brittle inorganic devices. Organic photochromic switchable compounds, like dithienylethenes (DTEs), are thermally stable, fatigue resistant and can undergo an electrically- and/or photo-induced ring-opening and -closing reaction which results in a change of energy levels. Due to the energetic difference in the highest occupied molecular orbital (HOMO) between the open and closed isomer, the DTE layer can be exploited as a switchable hole injection barrier that controls the electrical current in a diode.

In this work, investigations on enhancing, as well as elucidating effects and mechanisms in XDTE OMEM devices, will be demonstrated and analyzed.

More precisely, the elucidation of the current-induced switching mechanism and the influence of a side product formation in OMEM devices will be presented.

Further, new class of DTE molecules, namely perhydro DTEs, will be introduced to examine its properties and performance in OMEM devices.

Another major aspect in OMEM devices represents the data storage density. Within this work, two enhancements of increasing the current ON/OFF ratio are shown.

Last, a contrast of the open and closed state of XDTE in the transduction layer will be visualised by exploiting the DTE's switching related changes in properties upon isomerisation.