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(54) **NEMATIC LIQUID CRYSTAL COMPOSITION AND LIQUID CRYSTAL DISPLAY ELEMENT USING THE SAME**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 6,444,278 | B1 | 9/2002 | Reiffenrath et al. | |
| 6,896,939 | B2 * | 5/2005 | Klasen-Memmer | C09K 19/42 252/299.61 |
| 8,906,472 | B2 * | 12/2014 | Kuriyama | C09K 19/062 252/299.5 |
| 2003/0222245 | A1 | 12/2003 | Klasen-Memmer et al. | |
| 2004/0048401 | A1 | 3/2004 | Hembree et al. | |
| 2006/0011888 | A1 | 1/2006 | Reiffenrath et al. | |
| 2010/0272925 | A1 | 10/2010 | Goetz et al. | |

FOREIGN PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| DE | 10117224 | A1 | 2/2002 |
| JP | 06-235925 | A | 8/1994 |
| JP | 09-124529 | A | 5/1997 |
| JP | 2002-357830 | A | 12/2002 |
| JP | 2003-327965 | A | 11/2003 |
| JP | 2006-502205 | A | 1/2006 |
| JP | 2006-169472 | A | 6/2006 |
| JP | 2010-256904 | A | 11/2010 |
| WO | 2007/077872 | A1 | 7/2007 |

OTHER PUBLICATIONS

International Search Report dated Jan. 7, 2014, issued in corresponding application No. PCT/JP2013/080023.

* cited by examiner

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(57) **ABSTRACT**

There is provided a nematic liquid crystal composition that exhibits a negative dielectric anisotropy (Δ∈), the liquid crystal composition being useful as a liquid crystal display material, and a liquid crystal display element using the same. The liquid crystal composition has a large absolute value of the dielectric anisotropy thereof and a low viscosity. The liquid crystal composition can provide a liquid crystal display element which has a high contrast, high-speed responsiveness, and good display quality in which image sticking and display defects are not generated. The liquid crystal display element using the liquid crystal composition is a useful display element which realizes both high-speed response and suppression of display defects. In particular, the liquid crystal display element is useful as a liquid crystal display element for active-matrix driving, and can be applied to, for example, a VA-type or PSVA-type liquid crystal display element.

**7 Claims, No Drawings**