Induced Antiferroelectric Phases in Multicomponent Systems*

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Materials with induced antiferroelectric phase (SmCA *) composed of components having cl $c(S \nightharpoonup c^*)$ by all $(S \nightharpoonup A)$ has been studied. The characterization included fle fl^{it} transmission curves, e curves, ^he^h ld, and and hold lae, e cale, a cadd a ccaa a dcealebewee (+) and (exceptric states. The mode A_{70} -B₃₀ showed V-shaped (see shouldless) with , while the methods of the wed a threshold with a bradithe end effective curve of \mathbf{u} a e a fe elecc.

Key words: ec $c^T u$ dc al, indeed and club echange anticleuse c, elec ce e fulced a fe elecc

The dce faehehld a fe elecc^oru dc al a dhe $V - k a$ ed $(k \cdot e^k - k d)$ with small s [1,2]) all wed $\frac{h}{h}$ edesign of displays having in the design of the each few led e^{h} angle and grey level an $c^{\mathbf{h}}$ a acteristics. Soon is exerching the necessity of c . Soon is new time c is c is c of n is n is eccae al ba eae a e f e e, $h_a h_e$ a e al cu Id be be e adapted to different applications. Recently some of us observed h and an a cl c (a fe elec c) S C_A^* LC $\frac{h}{1}$ a e a be **u** ced b c e e, ced ula eul fachal cudwha fluored e al cha a da chial compound wha a ed e alcha [3,4]. The e also h_1 e bl ffula ulc e a fe eleccS C_A^* u e f c u dha cl cadh al ecchae. Such bl wa $w^{h₁}h₂$.

I h_1 w h_1 the electro-cal characterization in dynamic and static conditions in dynamic and static conditions of the fw e fulced a fe elecculce u e e e ed. The fuecaece functions and \mathbf{f} and \mathbf{f} and \mathbf{f} and \mathbf{f} and components and the second one contains and the second one contains and the second one contains and the second one components and the second one co ece faed ce. The a was baufdae alfa abut h e elec $-$ cal behaviour and to recognize their potential usefulness d la a l ca

^{*}Dedicated h_{e} e fP fe K fP α .

EXPERIMENTAL

Phaea ae e °C, ada eⁿale cal/l(*italic*).

The synthesis of compounds **1** and **2** and also **4** and **5** was recently described [5]. X-ray studies of **heecude** lae acdaaadcf a f^he haede fca wee ee ed [6,7]. The a cabec efece eau ee baedwha ew, hillece SETARAM 141 DSC u e f ew e a ed c u d.

C u d 1 a d $2^{\frac{h}{2}}$ are $\frac{h}{2}$ $\frac{h}{2}$ e are not c $\frac{1}{2}$ c c c C^*_{β} (c f ed b d electric permittivity of the almost \mathbf{A} and orthogonal smecthes ability to induce the induce t a feelecc^hae w^ha aed a e.C u d1 **d** ce C_Ahae shacud **2** [3]. The w-cud 3de uice hinae, but acud ability in ewh compounds **1** and **2**. The presence of compound **3** allows decrease of the melting point of the eutectic. The calulated composition of h_0 eutection of h_1 **2** and **3** h_1 ef II w \therefore **1** – 21.78 w. %; **2** – 34.97 w. % a d3 – 43.25 w. % (mixture A). Munical have dhe hase a cc 49°CS C^{*} 93°CS A 134° C I during the and c all ed a about 36° C during c 1.

The aed cehaehefll w uwe adhae and the following structures and phase transitions of the following structures and phase transitions:

C **u** $d4^h$ aaea cec A ^hae, ada cS I_A^* ^hae, cu $d5^h$ a an monotropic smectic A phase only, and compound **8** has only a monotropic nematic phase. Compound **6** hahee SC* ubhae, SAhae ada e de fed SX^hae belw 72°C. A e e we wf cble h a S K a S C_A^* h a e. The culumber and bdffee e^{μ} d.

C u d7^ha ecc I_A^* adA ^hae ad wub^hae C_α^* ad C_β^* . T^h c u dwa e ed $[10]$ hahas C* haeb a eeutewee ehee. Two ecc we e calu la ed and prepared: Eurectic B compound compound 4 and 5 $\frac{1}{2}$ ea. a. 47.23 w. %

 f **4** and 52.77 w. % if $\mathbf{5}$ in wed in e in a crystallized and it crystallized during the phase in the phase in the \mathbf{r} c 1 a 35°C. **E** eccCc a edc **u** d 4, **5**, **6**, **7** a d8 w^{**h**} we **h** ece a e 13.99, 9.27, 38.22, 18.52 a d 20.0 e ec el The hae a fue C we e: C 14–15°CS ζ_5^* 55°CS A $84\text{--}101^{\circ}\text{C}$ I.Icalled a abu $4\text{--}5^{\circ}\text{C}$. The eccS I_A^{*} was beed hee ue. The e eau ea de ^hal f^hae a f d ulal c u d wee eau edb a SETARAM 141 DSC calee. Phaeda a fA-B ad 1-C e wee baedb he lec ce a e^h d *via* we^h a e a a ed a le fabu 0.02 f each c ce a . The e e au e f $h_a e_a$ were eau ed with a LINKAM THMS 600 h_a and a BIOLAR PZO langle and a BIOLAR PZO polarizing and a BIOLA cal cce.Phaeweede fed bcccbe a .Phudcal uewee laced be ween \mathbf{F}_1 c c e late with \mathbf{u} ace.

Cell preparation and electro-optical characterization. The elec^{tro-optical (EO) e e f e -} aed ae al weechaace edb e fe e e Saca trua - a cbeha u ad ffe e e e an e dided half ce a le between ferelectric (+) and (e) and e states, electric cal e e (cal^h ee **u** e) a 1 H a u la wa ef , c a a a d h e h ld l a e. D a c behaviour dided e e (ead fall) e, e cale and dia cc and F he een e e, ^kecellweedee^keb le laale a^{nt}uaeule baledwaefor exercall developed for an electric and V- $^{\mathbf{h}}$ a ed and [11]. Cell a between 1.6–1.9 we eu ed. N 1 -6 (Aldr \dot{c} h) was used a alignment material in solution of 2,2,2, c^{h_1} c^{h_2} and w^{h_1} the different concentrations (d): 7.20, 14.4, 21.6 (h_2 ef alignment is deed a e, aand f e e c el f h e e c e a $\big|$). The alignment gives the best EO e c e at the best EO response at the best EO lwe eau e e fd a cadde , wh le ee adeu a ec a wa elected feach **u** e. \overline{u} ewa alwa 4^{μ} a 160 °C. The alie layer weeded by a temperature. The spinner speed was 3500 rpm in all cases. Spinning time was 30, 40, and 50 s for layers se, a, and free centrel \mathbb{P} lanar and \mathbb{P} alignment was used in all cases.

RESULTS AND DISCUSSION

Phase transitions in multicomponent systems A-B and 1-C. The h_{ae} dagram $f^h e$ e c ed fill a ed u e A a d a ed u e B h_w Fuel. The haeda a f^he e ced fc ud 1 ad a ed \bf{u} e C \bf{h} w F \bf{u} e 2.

The a le were laced between c c c l de w^{ith}u e lave a d ace. The lwe e e a u e f c all a $A-B$ u e we e fu d h_{e} a e f^h he c ce a fill aed c u d, while 1-C u e h_1 e weefud h_1 e a ef h_1 h_2 concentration of protonated compounds.

The ulceda feelectrics C_A^* has beed A-B efhecce a a e 2θ 75 w. % f B. I μ e al ab l μ μ e (abu 75^oC) f c ce a $40-50$ w. % fB, and decrease h_{a} and for h_{b} h_{e} and lower B conce a . Mu e A-B w^h B c ce a beween 20 and 40 w. % can be u ec led bel we e au e. The h_1 a e d a $(F u e 1)$ clerke h_a e d a a f h_b b c e e 14 dec bed [3]. H we e, h_b b -

Figure 1. Phaedaa fulce ueA-B. Ta ee ae ef heaceleae $\rm e$.

Figure 2. Phaeda a fulce ue 1-C. Ta e eau e f^hea cole ae e. Belef S C_A f c l added.

e ed a u f S C_A^* μ a e was 120 °C μ a case. The **u** ced S C_A^* μ a e be ed h_1 e 1-C e acce a 20–85 w. % f C. The h_1 aee a e e a e a $\frac{h}{2}$ a 100° C (Fue 2). The alable is vealdedendent is veaking the endemony of $\frac{h}{2}$ and $\frac{h}{2}$ an c ce a w^h ^he a e 25–70% w. $f C; h$ we e decease a dl **u** de h a e. M u e A-B c a 70 w. % flu a ed c e A and 30 w.% f a edc e B, (a eda W-119 m e) and mixture 1-C cona $15 \text{ w. } \%$ fil aed c u d l a d $85 \text{ w. } \%$ f aed u e C

(a ed a W-131) were elected for $\mathbf{f}_1 \cdot \mathbf{f}_2$ for \mathbf{f}_3 cal and electro-optical \mathbf{u}_3 denotes. Ducl^he ueW-119^h wedhefllw hae a :C 13^oC S C_A^* 61.5°C S C_β^* 90.5°C S A 109–125.6°C I; d^kea ue W-119 the transition SmCA * SmC* was observed at higher temperature (66.5-C). Mixture W-119 was ded w^{it} ac^hial compound **9** heamos f 20 w. % w^{ith} compo **u** d 10 11 12 e a a el h_1 e amounts 10 w. %. The end in the resulting means called W-119a, b, c, and d e ec el.

$$
c_{7}F_{15}COO(CH_{2})_{3}O\sqrt{0.000} = 0.000C_{8}H_{17} \quad C \quad \frac{83.3 - 84.5}{10.95} \quad (S \quad C \quad \frac{71.0}{0.08} \quad S \quad A \quad \frac{76.41}{1.40} \quad I \quad 9
$$
\n
$$
c_{7}H_{15}COO(CH_{2})_{3}O\sqrt{0.000} = 0.000C_{8}H_{17} \quad C \quad 1 \quad \frac{53.4}{1.14} \quad C \quad \frac{56.4}{11.56} \quad (S \quad A \quad 32.8) \quad I \quad 10
$$
\n
$$
c_{10}H_{21}O\sqrt{0.000} = 0.00C_{8}H_{17} \quad C \quad 1 \quad \frac{51.7}{1.02} \quad C \quad \frac{65.6}{7.88} \quad S \quad C \quad \frac{95.0}{1.16} \quad N \quad \frac{96.2}{1.14} \quad I \quad 11
$$
\n
$$
c_{5}H_{17} \sqrt{0.00C_{8}H_{27} \sqrt{0.000C_{8}H_{17}}} = 0.00C_{8}H_{17} \quad C \quad \frac{67.3}{8.10} \quad (S \quad I_{A} \quad \frac{56.0}{0.99} \quad S \quad C \quad \frac{85.6}{0.10} \quad N \quad \frac{156.7}{0.69} \quad I \quad 12
$$

In mew-119a, badc, having $\mathbf{u} \cdot \mathbf{h}$ and $\mathbf{u} \cdot \mathbf{h}$ and $\mathbf{v} \cdot \mathbf{h}$ and $\mathbf{v} \cdot \mathbf{h}$ and $\mathbf{v} \cdot \mathbf{h}$ fthe alablwa beeddeccobe a . Such behau was beedal bc e e a dee beachaace cfeau e f^{h_1}e u ceda cl c h_1 a e [3,4].

Mue W-119a, b, c a d d h wed h e f II w h a etheu e ce u c I- (\leftarrow) a d^hea (\rightarrow) :

The d $a = 9, 10, 11, 12$ deceae^he ab l f S C_A^* ^hae **u** e W-119 h e fllwwa:

$12 > 11 > 10 > 9$

The achial e e $12, h_a$ a led ecc C h_a e, u e ed hea fe elecc h_{a} e u eW-119 a c ce a ab e5 w $\%$, wh le h_{e} fl a ede e 9 \mathfrak{g} wed almost notice \mathfrak{g} influence the stability of the $20 \text{ w. } \%$. I a ed a alu e 10 decea ed ^{h}e ab l f S C_A^* u c^h e,

eal h e a ewa as de 11 d d, e a d le c u d 10^h a l h
al ec c A h a ew^h h e l w clease when h is $1 + h$ a h e l ed h a e (al ecc A ^hae w^h he lwclea, while 11 ^ha he led ^hae C. \mathbf{u} e W-131 had hae a $\frac{1}{A}$ 37 (52) S C_{^{6}} 70 S A</sub> $5 - 1101$

Temperature dependence of tilt angle. Fu e 3 h w h e e e a e de e de ce f^hehalf-ceale (θ) eau edbewee (+) and (e) ferroelectric ates for **u** e W-119 a d W-131. The cece deep deep cef u e W-119a, b, c
d d h w Fu e 4. a dd $\frac{k_1}{N}$ w Fu e 4.

Figure 3. Half-c eangle between $(+)$ and $(+)$ fend exchange of α is the α in the 119 and W-131 upon teme a u e. Cell 1.8 ; a u la 1 H wa ef a l ed.

Figure 4. Half-c ea lebe wee (+) a d (e) ferelection and ferral versions of mixtures 119 a, b, c and d upon teme au e.

W-119 a^{h} , h 1 u e. The a u 1 a $le(abu + 42^{\circ})$ achieved a 30 deee bel whe a S A hae. The h h l belwhe S A-S C^* a c^h aace cf ueca alaeau f c^h a fluored c e [6,12]. I Fue 3 $\frac{R_1}{r}$ ed f $\frac{R_1}{r}$ e la le θ e alewa beed declabe^lhe a e e a ve SC $_{\beta}^*$ -SA, fu db c c e be a in e ed a le **b** a a^{h h}ie e e a bene. The eem be a characteristic feaue f^hue ae al.Iwaal be edhe uwe. The ea f \mathbf{F}_1 d a be f II w \div a clec cl ceffec – a a c^h f level to the surface into a predted pretty the surface into a pretty the time of the time $a^{\mathbf{k}_1-\mathbf{k}_2}$ e e a e e .

The u e W-119 a d W-131 c f w beee a d h ee beee leule a d^{it}iecule tha edifferent ability adie und e h_1 e e u e $(h_1e_1e_2 - c_1h_1e_1 + c_1h_1e_2 + c_2h_1e_2 + c_2h_1e_1 + c_2h_1e_2 + c_3h_1e_2 + c_3h_1e_2 + c_4h_1e_2 + c_5h_1e_2 + c_6h_1e_2 + c_7h_1e_2 + c_7h_1e_2 + c_8h_1e_2 + c_9h_1e_2 + c_1h_1e_2 + c_1h_1e_2 + c_2h_1e_2 + c_3h_1e_2 + c_1h_1e_2 + c_1h_1e$ s_1 is the dimericance denotes the shorter tendency for shorter molecules, because fixed in the molecules, because fixed in i^h e acal position, what ought to influence also the hack call frequence also the influence also the space transitions. At the space of \mathbf{F}_1 e la eula ad huld be ede e e all, fea le eau h e h ae a h cell who different and cell whithe u face c eed b 1 e a ch LC leu le w^h different energy. The u e W-131^k a a lwe $\left(\theta = 25^{\circ} \right)$ k a W-119 a 30°C belw S A-S C^*_{β} a al e.

Мu e	e au $e^{o}C$ Te	θ /°
$W-119$	60.5	42
W-119a	56	39.5
W-119b	52	31
$W-119c$	60.6	40
W-119d	63.7	36
W-131	40	26

 ${\bf Table\ 1.}$ The late h e each ueae eau e30°C belw h ea SA-SC $^{*}.$

The effect of dopants on the half-cone and the fine method on the H angle of the mixture \mathbf{I} with \mathbf{I} and \mathbf{I} and a **9**, **11** a d **12**. D a **10 d** ce a ceable dec ea e f^{**h**}₁ e 1 (Table 1). The babl a c^{ons}equence f^h e absence falled sence h a e d a 10. *Temperature dependence of electro-optical transmission profile and response times*. The elec - cal (EO) behave fhe abelo-e ed u e ha bee u ded as cell a shown before. Funching the EO ree f u e W-119 a d W-131 a 1 H a u la wavef. The EO ee f u e W-119a, b, c a d d $\frac{h}{2}$ e wavef $\frac{h}{2}$ w Fu e 6. Ule $h_{\text{ewe a ed.}} h_{\text{ecell}} h_{\text{c e wa 1.8}}$ all case. Mue W-119 e- \mathbf{F}_1 e ablea fe eleccae a \mathbf{F}_1 e e e au ebel w 55 \degree C a d \mathbf{F}_1 w V- h_a edelectro-optical response with a small hyper-sponse constant a small hyper-service between v_a voltages between v_a adhe sua lae. The sua lae hhalwe esue $(20\,\mathrm{V})$ 12V/ a 30°C), a d decease w^{ith} c ea e e a e a 55°C u 15 V (8 V/ \mathcal{N} , The V-hae hysterall hysteresis and the set of $W-$ hae), which is more ceable at

Figure 6. C a felec-cal **v** e f **u** e : 119, 119a, b, c a d d a e e al e e a- \mathbf{u} e.

 h_1 h_2 e ear e. V- h_3 ed w c^h be ed u e W-131 al h_1 h_3 h_a a less able-

e e h_a h_b also less d h_e h_b a less stable subsets of h_b and h_b an u e W-119 u c^{μ} e e^lha^ke alabiliwe a d^hehe alheef SC^{*} a $d = h_{ea}$ and cooling temperature is observed and a brander temperature range. Mix u e W-131 h w a cal h e e u e f a e a fe elec c a e al w^h a e b ad^h ee l , a 40° C V_h = 14 V a d V _a = 17 V. The e e e a f S C^*_{β} S C^*_{A} a a alw lae (hld a Vh = 8 V) and finishes eal a $V = 0$ V. The h ld a d and saturation voltages decrease with c easing temperat ea $h_1e^h_1$ ee la we. The haefhen ee te e aa ed**u** C, whee SC^{*} ad SC^{*} hae ae aⁿ eu lbu. Sh **u** $e^{\mathbf{h}}a$ V- $e^{\mathbf{h}}a$ ed w $e^{\mathbf{h}}b$ belw S $C^*_{\beta} \rightarrow S$ C^*_{β} a d al S C^*_{β} h a e.

D a $\frac{9}{2}$ **12** affect $\frac{1}{2}$ e EO e e different way (Fu e 6). The d a 12 has helea effectelectro-cal et e. The saturation of a vertical voltage for W-119d eeⁿ heⁿ a beed ⁱn ueW-119 adhe af a f V-^kia ed W-^kia ed c^haacecea aalwee e ane (45°C). An ^kiw, h_1 u e^{no}eu eda^h h_1 e concentration of buffing a e al (furtace conditioning, see Table 2) to stabilize the V-shape at low temperature temperatures. The leads to a stronger stronger i a c^h wha culd a all e la ^h behau. D a 9 a d 11 (we W-119a a d W-119c) e l e l e l e E O e e f V- l a ed W- l a ed al ead a al we e e a e a d $\frac{h}{2}$ e a a is a set fectively deceased. The effectively a set is equal to a is a set of h expected. ee de u eW-119a h_a W-119c, but h_{c} ce a fined a $W-119a$ w e^{h h}e ha W-119c. The d a 10 ee he V-haed

 c^{μ_1} a ace a lwe eau ea ddeceae μ_1 e and mixe-saturation vers, μ_1 e mixu e W-119b c a h d a h w a e cular fleah h e e au e. I fac, h_1 e EO e e f u e W-119b cu ld be abl ed w h_1 and e edu face c d

Contrast and grey scale. The dependence of h_{e} and contrast $\int h_{\text{e}}$ e e ature campared for mixtures w-119 and W-131 Fue 7 and for mixture W-119a, b, c a d d if u e 8. M u e W-119 c a abu e^k e^k he h_a **u** eW-131 (*e.g.*, 70:1 a d9:1 e ec el a 35^oC). The **u** eW-119

Figure 7. Te eau edeedece f^h ec a a f f u e: W-119 ad W-131.

Figure 8. Te e \mathbf{a} e de e de ce $f^{\mathbf{h}}$ e contrast and for $f(\mathbf{u})$ e : W-119a, b, c and d.

 \mathbf{F}_1 w a u c a abu 100:1 a 65°C, where \mathbf{F}_1 e \mathbf{F}_2 this mixture al be ed. D bachalc u d deceae heca. The ded u e W-119d h_a h_{bc} and its equipedence h_e most similar to most similar $h_e h$ \mathbf{u} e W-119.

Fu e 9 h w h e de e de ce f h e d a c e cale h e a l ed l a e $h_1 e h_2$ ldle u e W-119, W-119a, b, c, d a d $h_1 e h_1$ ld u e W-131 a d h_1 e chaace cdaaee aeled Table 2. Da dffca^{l k}e le f^{k}edace cale **v**e. Da 12 decease de a el k e ee e $f^h e^h$ u eW-119 ad ceae he and increase. Da 11 and e ecall 9 d antically cearchie een entitled the steam and reduce the steam and reduce the saturation of the saturation of the saturation of the saturation of the steam and reduce the steam and reduce the steam and lae. A a $\frac{k_1}{2}$ a a u face c d $\frac{k_1}{2}$ be cen a $\frac{k_1}{2}$ - a c **b** e h_1 e e e u 1 . I h_1 u 1 d be c de ed, h_1 we e, h_1 a d ffe e **b** ff c d^have been ed de in order to optimize the low-temperature V- h_a or **u** e, *i.e.*, \mathbf{h}_1 e most interest interesting the applications point of ew. Oeu colde, ^kie efe, ^kiada 11 ad 9, b^kie ele ad/^kiu k h_1e ubtfcd, dicelw lae V- h_1 ae e responses: h_1e e fW-119a a **u** lale e \hbar ce, for a cae cable w^{ith} lw lae adadd elecc. The me W-131 ca V-^kiae u eW-119 ^kiwae be^hau w^{ik}iaduble^kie e I ad eed $a^{\,l_1-l_1}e$ la e f w c^{l_1} f l_1 e antiferroelec c l_1 e fe eleccaeadal we ca baed.

Figure 9. C a f e cale f^h e^h Idle u e: W-119, W-119a, b, c, d a d^h e^h Id - μ eW-131 a e ea μ e35°C.

Dace e^{-h} a ebe eau edade a e (60 fa e /). Adde wa efadde flagule ca befud [11].

(*) b a (*) d a lu beⁿa u .

(*) a alu beⁿa u .

(2) e e e we e eau edale a lunguar a lunguar what is be weed accule.

(2) e e (10% 9

The **u** cedectrical feedectric C_A^* has existent in equation of C_A^* a e fulce u e, cfheead w chale e w^h a all \mathfrak{g} and each alkow alkowy alkowy alkowy alkowy alkowy alkowy and the unit alkowy and the unit alkowy and the unit alkowy and the unit alkowy and alkowy and alkowy and the unit alkowy and alkowy and alkowy a ed cha. I a u able be ed h_{e} ce a a fill a ed a ed c e abu 1:1, $w^h a$ is h ebehaviour found e ultration previously for the mixtures $[3,4]$. S C ¹ C induced antiferrow induced and may be a contained monopole mixtures may also contain component may also contain composition of C e h_a are able d ce h_b are the antiferroelectric phase by the antiferred contains by the selves. Dopants by the selves. Dopan a be w chial c u d a well a achial e. The e e ce fd a allw dee chaefhe eef uec ed fhee cud, h_a led eccae alw^h e $e^{\ln a}$ edifferent than h_a materials and host materials with materials h_a (ad ω enfield in a icapations) abeforthed. Two types of ω induced a feeleccue fcce a f^he ae, whee he hae a a e, we e a ed a d e a ed. \mathbf{S} choice \mathbf{S} and \mathbf{A} ce \mathbf{A} und ceae a set with a -

decc C_A^* hae, which is the most optimal for V-shaped witch a Funda \mathfrak{a} ed [2], alh \mathfrak{a} hece lhttps: few \mathfrak{m} ed [13]. Only the first e, W-119, w^h a e ce we ^h f $\mathbf{\hat{n}}$ a ed c \mathbf{u} d, ^h wed V-^h a ed w c^h . The saturation variation voltage was found to be $\mathbb{I}^{h_1-h_1}$ (Table 2), although the be ed e cale was u e w de.

Recently we eased une containing the fluored compounds containing on \mathbf{u} and \mathbf{u} a d fu d V-ha ed w c^h whal w a lae [14]. The ef e, wuld be bleal h_1 in the induced medic bed h_1 is each of the induced medical voltage medical medical voltage medical voltage medical a be baied bable l efficially more fluoring more fluoring more fluoring more fluoring more fluoring more in T^h e in C W-119 h w a a h e d a c(55:1) a dd a c(40:1) c a a well a eal e cal e a d deca e and acce able a e f abu 250 r^{th} e e d u e(W-131) h_1 and h_2 and fire equity the property properties. It is shown that both, the child and saturated with h_1 , h_2 is the saturated and saturated with h_1 , h_2 is the saturated with h_1 , h_2 is t a lae a e w^{ith} cala fe elec c a e al. A w de^{lt} e e be ed between the antiferred electric $c \rightarrow fe$ electric and the ferroelectric transition and \rightarrow antiferroelectric transition. It is bablic containing the observation that the observation ecc C_A^* a d S_C^* hae ae lwl^{on}eu lbaed la e e e a ea dc cea a e, where \mathbf{h}_1 e e c c c induced [3]. The a e eul f he and f w c^{h} e wee baed. The e e hef u e W-131, while h_1 e fall the is ded time is not the material slowly related the materia a fe elec c a e af e elec c f eld e ed.

O^heeale fue W-119 he flece fachalee de ed a wee e aedad wafu dhahe aeable c^h a ehe ee $f^h e^h$ ue a eaeaeee, wha celaed which che cal $\mathfrak a$ and $\mathfrak b$ and $\mathfrak b$ influence $\mathfrak b$ influence on the an c^{μ_1} e^k eu V-^k a ed w c^{μ_1} (Table 2).

The ae^{h} ale e 12 decease h e e e effection h a h e dopa ; while ded a 11 decease less the e e The decease fine h e^k ld laead he and and the saturation voltage is observed for the saturation of the satur witching into the W-shaped with its the contrast is observed in the W-shaped switching, but the contrast is observed in the contrast is o

 a_1 **h** b_1 as b_2 **h** b_3 **u** e. The fluoring and ester **9** ed cend a call b_1 e h e h Idad and and Iae.

The eults in wed above d cate in a shower it is possible to indicate the clectric \mathbf{r} mew^{it}ilaee eaneaefecc^hial compⁱna l ecc C^*_{β} hae eccA hae. Such antiferroelectric materials, heccea a ewhere h_{e} and the electric phase and be induced, and we he h_1 e h_1 ld h_2 e h_1 ldle V- h_1 a ed/W- h_1 a ed w c^h_1 . D fferent achiral comund a be unced h_e une e $h_h h_a$ und h_e in h_a $20 \text{ w. } \%$). A fe electric all the ed by $\frac{h}{h}$ add $\frac{h}{h}$ we e, ac a d d a c EO c^h a ac e c a be b adl adv ed.

The cell fab ca c 1 la a important role in the final EO properties. The \mathbf{u} e ce furface c d h e h a e felec - cal u e a dd a c behaviour was beed h_{e} we [15]. Especially, h_{e} and face is very strong for s a e al w^h V-h_a ed w ch cha ac e c. I is not sepaa el h e c b ed ac f h eu face a d h e a e al elf. A a a e, eu l a f edc b a u face/a e al, l e^{h} e ch e f a al h_1 w, $e^{h_1}e$ eleaf a falca aa h_1 f wad wa.

I ee eⁿaV-haed woⁿ ee b**a** elaed he ee ce f ec c C_A^* hae. Neall he a e d felec - cal cha ac e c be ed u e W-119, w^h he a e f ec c C_A^* hae e ce, a d d f ed u cce W-119d, where 1 ec c C h a e e e e a l w e e au e.

Fil aed cudaeae a le fe^the caludae, where V-^khaed w c^h cu effeuel. The f V-haed ae al, Muad Mub^h u e [2], al have a fluoring a ed f a e ℓ e CF₃ u), but caved h e e hburh d fhechalce e. On the he had, he la fwch-W-119 and W-119d move is not surprising the necessary dyaccd fthe e e ed a feleccafe elecc \mathbf{F}_1 ae. Rece^{nt}ly, Rudquist *et al.* demonstrated that \mathbf{F}_1 e transition from the virginition from the virginition from the virginition from the virginition of the virginition of the virginition from the virgini a fe elec c fe elec cheh ld aewa be ed l ahef c cle f a ledelec cfeld [13]. Indiance difilition from f (+) ferroelec cae ϵ) feeleccae ealed. Therefore, he beed a

 h e me W-119 ad W-119d have he a e ane adac \mathcal{P}_{eu} e ce he elec- cal e e a e h e a e.

The fula fhea fe elecchaeb dice able e ba a a e fae al w^hd la e e f^he a e c e u c^ha the elation contrations.

Conclusions. The ae al fulaed by induction and chiral solution compound are quite promising for a compound for a compound for a promising for a property $f(x) = f(x)$ or $f(x) = f(x)$. d c flaef V- h_1 ae w c^h huld be baed. Oe f h_1 e wa culd be a cease f^h be content functionated compounds in the mixtures as well as h be **introduction** of a sedd a . A sensor of the interestion of the inter different chemical un que e appears appears to be necessary.

Ac wled e

Facalu f $h_{e}P1 h_{Sae}C$ eef Sce fcReea c^{h} (a N 3T09A 073 15) and C a ded de Mad $d(S \t a)$ ec . 07T/0038/2000 a e a ef II ac wled ed.

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