Three-dimensional imaging of liquid crystal structures and defects by means of holographic manipulation of colloidal nanowires with faceted sidewalls†

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to vaporat t sopropanol at ~ . °C on a otp at na
tur ons st n o op C C an ro s was st rr ust
or t C C pr parat on to prov t qua t o
sp rs on FC an po ar n ros opp t tur s s ow t at
t Ga nanow r rts tan nt ar sur a oun ar on t ons
on t qu star r tor ar ns para r to t an nor
a t ona ro ar r tor stort ons app ar on att ro s n s
F an w t stu struc ur s an s r an
unp rtur

o pro ot app aran o s o at ons n o st r ra a
w C C s w t as ar ra an α ° an p anar
o st r struc ur w r ar at us o t
ass p at s su strat s w r sp n pat w t ~ wt
so ut on o po v m ar p o A n on wat r at . . .
rp o ow a n n an ov n or at . . °C wo t p s
o s w r us or so s t A pat su strat s w r
ass w t no urt r tr at nt w r or t ost s t
A pat su strat s w r un r t ona ru w t
a v v t ot to or t qu star o u s to ar n para r
to t ru n r t on s ap s w r pr par
us n . μ spa rs on on o t an no spa rs on t
oppos t s w r t n w t a qu star an
s ar w t po on n nt o t C C nto t w
s ap s pro ot a app aran o s su as
s o at ons an s nat ons w w av a ans
o FC an ass a or n to t s o an an
Fr r [16] In t so ar λ s nat ons t at r ar n r tor
r s non s n u ar aus o n n para r to t n
n ts or so t at t s n u ar t s o s rv on nt a
t r ar r tor r s o C C a s c an τ ort o ona to
ot n an c In t s nat ons t τ r s non s n u ar ut
n an c r tor r s ar s n u ar In χ s nat ons t
s n u ar t s ar oun n n an τ r tor r s ut not nt
c r

2.2. Integrated optical setup for imaging and manipulation

o an pur at nanow r s w av ut o o rap opt ar
tw rs H [15,25] In t H s tup F a pp at
a ro a n an po ar Ytt r u op r as r I G
oton s λ = . n s r s at r s opp to s t ov r
t a t v ar a o t p as on spat a t o u ator Bou r
on n ar st s av us as r trap pow rs o .
s a r t an t C C r a n nt t r s o A t r n
r t o t t a s oup nto t a ap rtur
o a . × o rs on ros opp o t v A =
trans ss on at . n us n as on t s opp s on
t s opp nt so ar arran nt a so a s t p as
pro n p t to t a o ar p an o t
ros opp o t v o o ra s spa a on t
r at trap patt rns nt o ar p an o t ros opp o t v
A ro ro rror C ro a r ts t trapp n as r a nto
t ros opp o t v w r trans ts v s r r t us or

ro s ap or n s ap nanopart s a n n w t t
r tor to n an t r spons to t rna a n t s
ar ast t at a n nt o nanoro s n C Cs
w t opt a tuna o st r p t a ow or a v n
rotat on o o a ro s ans o opt a u nat on

n sp rs n C Cs t nanow r s or nt ar on **n r** o t qu r u r p ar struct ur F As t o st r p th r as s ro n nt n at t ot us r at v s ort p th va u s o μ w t t a t on o t ra opant a r t an ur ar str ut on o nanow r or ntat ons roa ns F ar t ou t w t o t str ut on r ans a ra t on o r v n or t C C w t $p =$ μ r ason or t str ut on roa n n s r t att transv rs s o t nanow r r spon s to a rta n an ur ar tw st o t qu r r u r p ar struct ur o t C C . $p \sim$. r s or $p =$ μ s r su ts n a w a r ast suppr ss on o t an ur ar t r ar u uat ons o t nanow r nt C C atr as p par to t as o t n at ar t ou t or o ar nanow r st ar ns para r to t o ar **n r** r spon n to t nt r o t nanow r

ontro an pro D nanow r or ntat ons an pos t ons n t C C us o a p nat on o o rap opt ar tw rs wor n at $\lambda =$. n opt ar trans ss on ros opp an a st pp r otor ontro n t sa p s v rt ar pos t on r at v to t o ar p an o an o t v w t . n pr s on For opt ar an pur at on on or two as r traps ar pos t on att n s o a nanow r an t n us to rotat an ov t n D In C Cs nanow r or ntat on an pos t on ar on t r ar a s ar oup to a ot r trans at on a ross t //o st r r ar rs s poss on $v a$ rotat on o ow n t r ar **n r** F an o an n ss o t an t rotat on r t on t r n w t r t nanow r ov s upwar or ownwar ts trans at on awar ro t ros opp o t v st p ar as r t an towar t u to t s att r n or s or nat n ro t ar nanow r C C r ra t v n s at asur v rt ar pos t on $_{nw}$ o a nanow r ar on t r s a n ar un t on o ts n p an or ntat on an ϕ_{nw} F ons st nt w t t **n r** o t qu r u r p ar struct ur **n** = ps πp s n πp . Fro t n ar t o t p r nta ata s own n F $_{nw} = \phi_{nw} p$ π t asur t v p th s $p =$. μ at n t at o ta n ro t FC ross s t on n t sa ro at on top r t ns t o F

In or r to app our t n qu to a n o p D r tor struct ur s an ts w av onstruct w o st r th s w t a ra an a out an stron sur a anor n t at ps n ar sur a o st r ra rs para r to su strat s E nta r s o at ons p rp n ur ar to t r t on o t t n ss ra nt ntro u a t ona o st r ra a n a ppor w t n r as n t n ss o t w F s s o at ons av t r r s sp nto s nat on pa rs an ar o t n a p pan ot r o st r ts or n p p D pon urat ons o **n r**

A t ou t non struct v D a n o **n r** aroun ts an a v ans o o rap ar an pur at nanow r s ar on w us FC a n or t p parat v ana s s o nanow r pos t ons an or ntat ons r at v to **n r** In t v rt ar FC ross s t ons t nanow r s or nt ort o ona to t pon o ar a v r s to a ar tr an ur ar w spr a n upwar ro t pos t on o t ro F a w s u to t s att r n o t FC tat on t t t n Ga nanow r $n_{Ga} =$ u ar r t an t v C C n s w t n pt ar trans at on o a nanow r s rv s as a s n part pro o **n r** ow n on not on to asur t qu r u pt ut so to ap an s n ts t v va u u to ts r n r su ts t at ar n a r nt w t FC a n F pon o ar v rt ar ross s t ons n F s ow s qu nt a trans at on o t nanow r a on a Bur rs r u t w t t trans at on a ross t o st r r ar rs p nt rotat n t nanow r att pt opt ar trans at on o a nanow r a ross t s o a t on s ont nu t n a a r C C struct ur su ts n str th n o t s o at on r s st ts n t ns on or a p w n ov n t nanow r ro po nt n F to t r t w o s rv t at as t s o at on v ntua ov s to t r t an str th s w n t nanow r approa s t t or A p nat on o rotat ona an trans at ona ot on

upwar or ownwar n a[illegible]or w t t sp a[illegible] nt o t
a rs to pr s rv ts or ntat on para[illegible] to t o[illegible] **n r**

nons n ur ar sH nat ons n ts H pr sp t nto t λ
pa r n t nanow r s p aH on t λ sH nat on s o

Supplementary Information

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