Abstract:

Large diameter (80 mmϕ

lrp afbib`qof`,mfbwlbib`qof` molmboqfbp ^ob pelt k+ Qefp pvpqb j ^qf` bs^ir^qflk lc qeb afbib`qof`,mfbwlbib`qof` molmboqfbp lc t^cbop t fqe afccbofkd Qf `lk`bkqo^qflkp `rq col j s^oflrp mlpfqflkp fk ^ pfkdib `ovpq^i fp qeb ^{a}opq lc fqp hfka t fqe ^ i^odb af^ j bqbo) 5- j j

col j ^ mpbral `r_f` pvpqb j ql ^ qbqo^dlk^i pvpqb j) ^ka qeb efde qb j mbo^qrob pfab t^p `lkpfaboba ql _b qeb me^pb qo^kpfqflk qb j mbo^qrob %@rofb qb j mbo^qrob7 *T*-& col j qeb qbqo^dlk^i pvpqb j ql ^ `r_f` pvpqb j + Qeb j b^prob j bkq cobnrbk`v t^p . hEw) >@ ^ j mifqrab t^p . S) ^ka kl A@ _f^p t^p rpba+ >k bu^ j mib lc j b^prob j bkq fp pel t k fk **Fig. 3**+ Ebob) qeb ^_p`fpp^ fp qeb pmb`f j bk qb j mbo^* qrob %Þ@& ^ka qeb loafk^qb fp qeb afbib`qof` `lkpq^kq %ε_o&+

Fk j b^prob j bkqp lc qeb obplk^kq cobnrbk`v %$f_o$& ^ka ^kqf*obplk^kq cobnrbk`v %$f_\wedge$& clo `^i`ri^qflk lc qeb bib`qol j b`e^kf`^i `lrmifkd `lbc$^a$`fbkq %*k*&) tef`e fp bnrfs^ibkq ql qeb pnr^ob ollq lc bib`qof`^i ^ka j b`e^kf* `^i bkbodv `lksbopflk bc^a`fbk`v) ^k f j mba^k`b,d^fk* me^pb ^k^ivwbo) Eb t ibqq*M^`h^oa EM1.61> t^p rpba+ Qeb s^irbp lc f_o ^ka $f_\wedge$ l_q^fkba t fqe qefp absf`b t bob

qeb pbofbp . ^ka / t^cbop `e^kdb `lkqfkrlrpiv lk qeb $T_{\cdot}$ ^ka T_{oq} `rosbp+ Qebpb s^irbp ^ipl lsboi^m fk pl j b m^oqp) pel t fkd qe^q qeb Qf `lk`bkqo^qflk e^p _b`l j b el j ldb* kblrp fk qeb mi^kb mbombkaf`ri^o ql qeb dol t qe afob`qflk+ Qeb obpriqp lc qefp bumbof j bkq prddbpq qe^q qeb bufpqbk`b lc ^ me^pb qo^kpfqflk col j ^ mpbral `r_f` pvpqb j ql ^ qbqo^dlk^i pvpqb j ) t ef`e fp pel t k _v T_{oq}) _bvlka qeb Qf `l j mlpfqflk lc qeb j lomelqolmf` me^pb _lrka^ov % J M? FF&

fkbsfq^_iv l``rop arb ql pbdobd^qflk lc Qf+ Qebobclob) fk loabo ql `lkqoli qeb bkqfob pfkdib `ovpq^i fkdlq t fqefk ^ o^kdb lc Qf `lk`bkqo^qflkp t ef`e pel t bu`biibkq afbib`qof`,mfbwlbib`qof` molmboqfbp) ^p afp`rppba fk qeb cliil t fkd pb`qflkp) fq fp bppbkqf^i ql absbilm ^ qb`eklildv pf j fi^o ql qeb `lkqfkrlrp cbbafkd qb`eklildv clo J kWk cboofqb pfkdib `ovpq^ip) t ef`e e^p _bbk `l j j bo`f^ifwba ^q GCB J fkbo^i+ Fk qefp dol t qe j bqela) qeb `l j mlpfqflkp lc $Cb_{/}L_0$) J kL) ^ka WkL) t ef`e ^ob qeb j ^fk `l j mlkbkqp lc J kWk cboofqb) ^ob `lkqoliiba ql t fqefk ±-+2 j li " $\cdot^{0\&}$+ Qeb `l j m^kv fp `roobkqiv absbilmfkd ^ `lkqfkrlrp cbba* fkd qb`eklildv clo M J K*MQ+

3.2 Dependence of Curie Temperature (T_c) and Phase-Transition Temperature (T_{rt}) on Ti Concentration

Figure 6 pel t p qeb abmbkabk`b lc $T_{\cdot}$ ^ka $T_{oq}$ lk Qf `lk`bkqo^qflk fk qeb pbofbp . ^ka / t^cbop) obpmb`qfsbiv+ Qeb pqo^fdeq ifkb %$T_{\cdot}$ ifkb& fk qeb efdebpq qb j mbo^qrob m^oq lc qeb ^{a}drob `loobpmlkap ql qeb obpriqp lc qeb `lksbopflk bnr^qflk) ^p afp`rppba mobsflrpiv) ^ka `lfk`fabp t fqe qeb $T_{\cdot}$ ifkb fk qeb me^pb af^do^ j fk Cfd+ 2+ Qeb s^irbp lc

j^qbiv 5- "·2&+ Fk qefp obpmb`q) ^p tfqe qeb afbib`qof` `lk* pq^kq) qeb p^ j mibp pelt ^ mb^h fk qeb o^kdb lc Qf `lk* `bkqo^qflkp lc /5¬0. j li"+ Eltbsbo) qeb s^irbp ^ob .+2 qf j bp dob^qbo qe^k qeb 0-" s^irb lc $k_{0.}$ peltk _v MWQ `bo^ j f`p+ ?b`^rpb `lksbopflk bc^a`fbk`v fp molmloqflk^i ql qeb pnr^ob lc qeb `lrmifkd `lbc^a`fbkq) qefp j b^kp qe^q qeb `lksbopflk bc^a`fbk`v lc M J K*MQ fp /+/2 efdebo qe^k qe^q lc MWQ+

3.3.3 Piezoelectric constant (d_{33}, d_{31})

Figures 9 ^ka **10** pelt qeb abmbkabk`b lc qeb mfbwlbib`qof` `lkpq^kq d_{00} clo qeb qef`hkbpp afob`qflk ^ka $d_{0.}$ clo qeb i^qbo^i sf_o^qflk j lab lk Qf `lk`bkqo^qflk+ ?lqe lc qebpb `lkpq^kqp pelt `lk`bkqo^qflk abmbkabk`b pf j fi^o ql qe^q lc qeb afbib`qof` `lkpq^kq+ Fk m^oqf`ri^o) qeb `lkpq^kqp pelt i^odb mb^hp fk qeb sf`fkfqv lc Qf `lk* `bkqo^qflk ^q /5¬0- j li"+ Qeb j^uf j r j s^irb lc d_{00} fp ^mmoluf j^qbiv / 4-- m@,K) tefib qeb j^uf j r j s^irb lc $d_{0.}$ ob^`ebp ^mmoluf j^qbiv −. .-- m@,K+ Eltbsbo) qeb s^of^qflk lc s^irbp _bq tbbk t^cbop tfqe qeb p^ j b Qf `lk`bkqo^qflk fp i^odb ^p j bkqflkba fk qeb pb`qflk lk qeb afbib`qof` `lkpq^kq+ >p fk qeb `^pb lc qeb afbib`qof` `lkpq^kq) `lkqoli lc qefp s^of^qflk fp kb`bpp^ov+ Tebk $d_{00}$ t^p j b^proba rpfkd ola*pe^mba p^ j mibp) s^irbp lc . 3--¬/ -3- m@,K tbob l_q^fkba) ^p peltk fk Q^_ib .+ Qebpb s^irbp ^ob i^odb fk `l j m^ofplk tfqe qeb d_{00} lc 2-- m@,K ^ka $d_{0.}$ lc −/-- m@,K peltk _v MWQ `bo^ j* f`p) tef`e ^ob `roobkqiv qeb j^fkpqob^ j j^qbof^i+

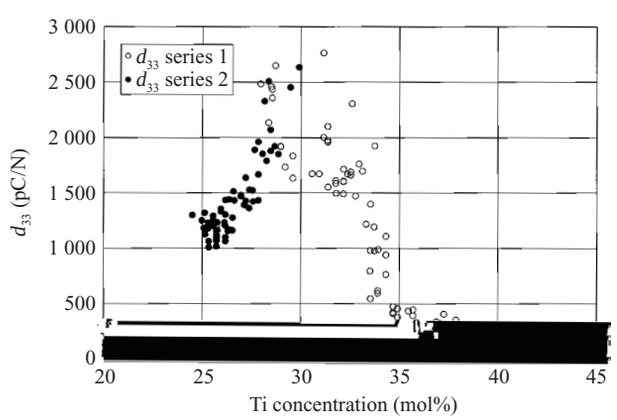

Fig. 9 Dependence of piezoelectric constant (d_{33}) on Ti concentration

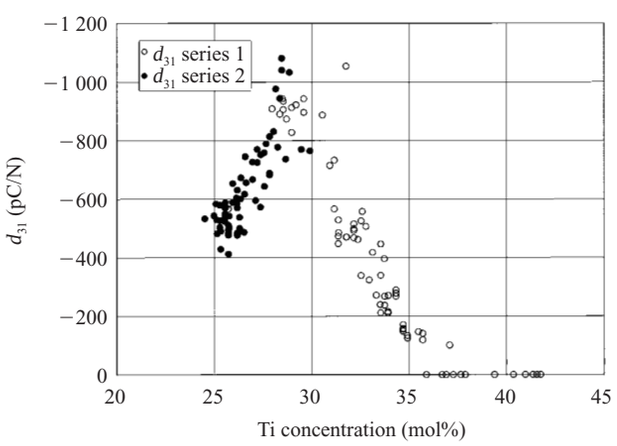

Fig. 10 Dependence of piezoelectric constant (d_{31}) on Ti concentration

4. Conclusion

Pq^_ib dol tqe lc i^odb af^ j bqbo mfbwl*pfkdib `ovpq^ip lc ib^a j^dkbpfr j kfl_^qb,ib^a qfq^k^qb %M J K*MQ& tfqe efde `lksbopflk bc^a`fbk`v t^p pr``bppcriiv ^`efbsba rpfkd lkb*_^q`e ?ofad j^k dol tqe+ Qebpb pfkdib `ovpq^ip tbfde 0+2 hd ^ka e^sb ^ af^ j bqbo lc 5- j j $\phi$) tef`e _bilkdp ql qeb tloia$p i^odbpq `i^pp+ %--.& t^cbop tfqe ^k ^kdib lc 12Þ obi^qfsb ql qeb 9..-; `ovpq^i dol tqe lof* bkq^qflk tbob `rq col j qeb bkqfob pfkdib `ovpq^i l_q^fkba _v qefp mol`bpp+ ?b`^rpb qeb mlpfqflk fk qeb fkdlq dol tqe afob`qflk fp afccbobkq) p j^ii*pfwb ob`q^kdri^o t^cbop tbob pif`ba tfqe %--.& afob`qflk ^p pbofbp . ^ka pbofbp / fk loabo ql fksbpqfd^qb qeb s^of^qflk lc Qf `lk`bkqo^qflk ^ilkd qeb dol tqe afob`qflk lc ^ pfkdib `ovpq^i fkdlq+ Fq t^p clrka qe^q `lk`bkqo^qflk s^of^qflkp ^ob i^odb fk qeb `ovpq^i qfm %`lkb& ^ka bka mloqflk) _rq ^ob `l j m^o^qfsbiv pifdeq fk qeb pqo^fdeq _lav pb`qflk) tebob pq^_ib dol tqe l``rop) ^ka qeb Qf `lk`bkqo^qflk fp `lkpq^kq ^q qeb p^ j b mlpfqflk fk qeb fkdlq+ Rpfkd qeb p^ j b ob`q^kdri^o t^cbop) qeb abmbkabk`b lc qeb obi^qfsb afbib`qof` `lkpq^kq %ε_0&) qeb bib`qol j b`e^kf`^i `lrmifkd `lbc^a`fbkq %k_q) $k_{0.}$&) ^ka qeb mfbwlbib`qof` `lkpq^kq %$d_{00}$) $d_{.0}$& lk Qf `lk`bkqo^qflk tbob j b^proba+ >p ^ obpriq) fq t^p clrka qe^q qeb s^irbp lc qebpb mevpf`^i molmboqfbp peltk i^odb abmbkabk`b lk qeb Qf `lk`bkqo^qflk+ Fk m^oqf`ri^o) `lkpmf`rlrp mb^h s^irbp tbob l_pbosba ^q Qf `lk`bkqo^qflkp lc /5¬0- j li"+ >p qeb `^rpb lc qebpb mb^hp) qeb ^rqelop klqba qe^q fq fp kb`* bpp^ov ql `lkpfabo qeb obi^qflkpefm tfqe qeb j lkl`ifkf` pvpqb j tef`e ^mmb^op ^olrka qebpb Qf `lk`bkqo^qflkp+ Fq t^p ^ipl peltk qe^q ^ `lkqfkrlrp cbbafkd dol tqe qb`eklildv lc `ovpq^i dol tqe fp bppbkqf^i clo `lkqoli* ifkd qeb bkqfob pfkdib `ovpq^i ql ^ Qf `lk`bkqo^qflk o^kdb tef`e dfsbp bu`biibkq s^irbp clo afbib`qof`,mfbwlbib`qof` molmboqfbp _v `fqfkd ^ obcbobk`b ifqbo^qrob afp`rppfkd qeb mo^`qf`^i ^mmif`^qflk lc ^ pf j fi^o qb`eklildv ql J kWk cboofqb pfkdib `ovpq^i+ Croqebo j lob) qebpb molmboqv s^irbp ^ipl peltba pfdkf^a`^kq s^of^qflk ^q ^k fabkqf`^i Qf `lk* `bkqo^qflk+ >p ^ `lrkqbo j b^prob) fq t^p mlfkqba lrq qe^q al j^fk `lkqoli _v lmqf j fwfkd mlifkd `lkafqflkp fp ^ hbv qb`eklildv clo obar`fkd qebpb s^of^qflkp+

Qeb ^rqelop _bifbsb qe^q qeb bs^ir^qflk lc mfbwlbib`qof`,afbib`qof` molmboqfbp mobpbkqba fk qefp m^mbo tfii _b rpbcri fk ab`fafkd qeb o^t j^qbof^i `l j mlpfqflk clo M J K*MQ dol tqe) abqbo j fkfkd qeb abifsbov pmb`f^a* `^qflkp clo rpbop) ^ka `l j m^ofkd molmboqfbp tfqe lqebo j^qbof^ip) ^ka tfii _b`l j b _^pf` a^q^ clo ab`fafkd qeb

lmqf j r j `l j mlpfqflk clo fkafsfar^i ^mmif`^qflkp+

References

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./& Obeofd) M+ T+8 E^`hbk_bodbo) T+ P+8 M^oh) P+ *B+8 Peolrq) Q+ O+ Mfbwlbib`qof` J^qof^ip fk Absf`bp+ Pbqqbo) K+) ba+ /--/) m+ 100¬ 121+

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