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# A Protective Hydrophobic Coating for CsI(Tl) Crystals

# [A. L. Shpilinskaya](https://link.springer.com/article/10.1134/S0020441219060137#auth-1),  [A. M. Kudin](https://link.springer.com/article/10.1134/S0020441219060137#auth-2),  [L. A. Andryushchenko](https://link.springer.com/article/10.1134/S0020441219060137#auth-3), [A. V. Didenko](https://link.springer.com/article/10.1134/S0020441219060137#auth-4) & [O. V. Zelenskaya](https://link.springer.com/article/10.1134/S0020441219060137#auth-5)

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A composition and method for applying a hydrophobic protective coating on the radiation input surface of CsI(Tl) crystals is proposed. The coating is a composition of polymer (fluoroplastic varnish) and solvent (ethyl acetate). The optimal composition of the coating composition with a thickness of ~2 µm was determined. The method of application involves the preliminary exposure of the sample in pairs of hexamethyldisilazane to increase the adhesion of the coating to the surface. It is shown that the replacement of a 5-μm-thick acrylic film with a 2-μm-thick fluoroplastic coating allows an increase in the light output of the α-detector by 14%, while the energy resolution improved from 6.28 to 4.96%.

## REFERENCES

1. Lecoq, P., Gektin, A., and Korzhik, M., *Inorganic Scintillators for Detector Systems,* Springer, 2017.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=Inorganic%20Scintillators%20for%20Detector%20Systems&publication_year=2017&author=Lecoq%2CP.&author=Gektin%2CA.&author=Korzhik%2CM.)

1. Grupen, C. and Shwartz, B., *Particle Detectors,* Cambridge: Cambridge Univ. Press, 2008.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=Particle%20Detectors&publication_year=2008&author=Grupen%2CC.&author=Shwartz%2CB.)

1. Kudin, A.M., Borodenko, Yu.A., Grinyov, B.V., Didenko, A.V., Dudnik, A.V., Zaslavsky, B.G., Valtonen, E., Eronen, T., Peltonen, J., Lehti, J., Kettunen, H., Virtanen, A., and Huovelin, J., *Instrum. Exp. Tech.,* 2010, vol. 53, no. 1, p. 39.

[**Article**](https://doi.org/10.1134/S0020441210010057)**[Google Scholar](http://scholar.google.com/scholar_lookup?&title=&journal=Instrum.%20Exp.%20Tech.&volume=53&publication_year=2010&author=Kudin%2CA.M.&author=Borodenko%2CYu.A.&author=Grinyov%2CB.V.&author=Didenko%2CA.V.&author=Dudnik%2CA.V.&author=Zaslavsky%2CB.G.&author=Valtonen%2CE.&author=Eronen%2CT.&author=Peltonen%2CJ.&author=Lehti%2CJ.&author=Kettunen%2CH.&author=Virtanen%2CA.&author=Huovelin%2CJ.)**

1. The FAZIA Collab., Bougault, R., Poggi, G., et al., *Eur. Phys. J. A,* 2014, vol. 50, p. 47.  <https://doi.org/10.1140/epja/i2014-14047-4>
2. Kudin, A.M., Sysoeva, E.P., Trefilova, L.N., and Zosim, D.I., *Nucl. Instrum. Methods Phys. Res.,Sect. A,* 2005, vol. 537, p. 105. <https://doi.org/10.1016/j.nima.2004.07.245>

[**Article**](https://doi.org/10.1016/j.nima.2004.07.245)**[Google Scholar](http://scholar.google.com/scholar_lookup?&title=Nucl.%20Instrum.%20Methods%20Phys.%20Res.&journal=Sect.%20A&doi=10.1016%2Fj.nima.2004.07.245&volume=537&publication_year=2005&author=Kudin%2CA.M.&author=Sysoeva%2CE.P.&author=Trefilova%2CL.N.&author=Zosim%2CD.I.)**

1. Vydai, Yu.T., Tarasov, V.A., Kudin, A.M., Andryushchenko, L.A., Ananenko, A.A., Kilimchuk, I.V., Boyarintsev, A.Yu., and Klimov, A.V., *Instrum. Exp. Tech.,* 2006, vol. 49, no. 3, p. 314.

[**Article**](https://doi.org/10.1134/S0020441206030031)**[Google Scholar](http://scholar.google.com/scholar_lookup?&title=&journal=Instrum.%20Exp.%20Tech.&volume=49&publication_year=2006&author=Vydai%2CYu.T.&author=Tarasov%2CV.A.&author=Kudin%2CA.M.&author=Andryushchenko%2CL.A.&author=Ananenko%2CA.A.&author=Kilimchuk%2CI.V.&author=Boyarintsev%2CA.Yu.&author=Klimov%2CA.V.)**

1. Kudin, A.M., Andryushchenko, L.A., Gres’, V.Yu., Didenko, A.V., and Charkina, T.A., *Opt. Zh.,* 2010, vol. 77, no. 5, p. 7.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=&journal=Opt.%20Zh.&volume=77&publication_year=2010&author=Kudin%2CA.M.&author=Andryushchenko%2CL.A.&author=Gres%E2%80%99%2CV.Yu.&author=Didenko%2CA.V.&author=Charkina%2CT.A.)

1. Kudin, A.M., Zosim, D.I., and Yemelyanov, A.Yu., *Bull. Khark. Nats. Univ., Phys.,* 2018, vol. 28, p. 40. https://doi.org/10.26565/2222-56172018-28-03
2. Shkoropatenko, A.V., Kudin, A.M., Andryushchenko, L.A., Voloshina, L.I., Zosim, D.I., and Voloshin, A.V., *Fiz.Inzh. Poverkhn.,* 2015, vol. 13, p. 175. https://periodicals.karazin.ua/pse/article/view/4556.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=Fiz.&publication_year=2015&author=Shkoropatenko%2CA.V.&author=Kudin%2CA.M.&author=Andryushchenko%2CL.A.&author=Voloshina%2CL.I.&author=Zosim%2CD.I.&author=Voloshin%2CA.V.)

1. Aulchenko, V.M., Baibusinov, B.O., Baldin, E.M., and Bondar, A.E., *Nucl. Instrum. Methods Phys. Res.,Sect. A,* 1996, vol. 379, p. 502.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=Nucl.%20Instrum.%20Methods%20Phys.%20Res.&journal=Sect.%20A&volume=379&publication_year=1996&author=Aulchenko%2CV.M.&author=Baibusinov%2CB.O.&author=Baldin%2CE.M.&author=Bondar%2CA.E.)

1. Andryushchenko, L.A., Kudin, A.M., Goriletsky, V.I., Zaslavsky, B.G., Zosim, D.I., Charkina, T.A., Trefilova, L.N., Renker, D., Ritt, S., and Mzavia, D.A., *Nucl. Instrum. Methods Phys. Res.,Sect. A,* 2002, vol. 486, p. 40. [https://doi.org/10.1016/S0168-9002(02)00672-1](https://doi.org/10.1016/S0168-9002%2802%2900672-1)

[**Article**](https://doi.org/10.1016/S0168-9002%2802%2900672-1)[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=Nucl.%20Instrum.%20Methods%20Phys.%20Res.&journal=Sect.%20A&doi=10.1016%2FS0168-9002%2802%2900672-1&volume=486&publication_year=2002&author=Andryushchenko%2CL.A.&author=Kudin%2CA.M.&author=Goriletsky%2CV.I.&author=Zaslavsky%2CB.G.&author=Zosim%2CD.I.&author=Charkina%2CT.A.&author=Trefilova%2CL.N.&author=Renker%2CD.&author=Ritt%2CS.&author=Mzavia%2CD.A.)

1. Zakharin, Ya.A., Dobryak, V.M., Govorova, R.A., Gladkova, I.V., Pomerantsev, V.V., and Zamyatin, Yu.V., in *Monokristally, Stsintillyatory i Organicheskie Lyuminofory* (Monocrystals, Scintillators, and Organic Luminophores), Kharkov, 1969, issue 5, p. 37.
2. *Promyshlennye ftororganicheskie produkty. Spravochnoe izdanie* (Industrial Fluor-Organic Products. Handbook), Maksimov, B.N., , Ed., St. Petersburg: Khimiya, 1996.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=Promyshlennye%20ftororganicheskie%20produkty.%20Spravochnoe%20izdanie%20%28Industrial%20Fluor-Organic%20Products.%20Handbook%29&publication_year=1996)

1. Kargin, N.I., Mikhnev, L.V., and Gusev, A.S., *Poverkhnost,* 2003, no. 3, p. 77.
2. Kudin, A.M., Mitichkin, A.I., Charkina, T.A., Zaslavskii, B.G., Vasetskii, S.I., Rebrova, T.P., Zagoruiko, Yu.A., and Mateichenko, P.V., *Opt. Zh.,* 2007, vol. 74, p. 70.

[**Google Scholar**](http://scholar.google.com/scholar_lookup?&title=&journal=Opt.%20Zh.&volume=74&publication_year=2007&author=Kudin%2CA.M.&author=Mitichkin%2CA.I.&author=Charkina%2CT.A.&author=Zaslavskii%2CB.G.&author=Vasetskii%2CS.I.&author=Rebrova%2CT.P.&author=Zagoruiko%2CYu.A.&author=Mateichenko%2CP.V.)

1. Zaslavsky, B.G., Grinyov, B.V., Suzdal, V.S., Kudin, A.M., Kisil, I.I., Vasetsky, S.I., and Mitichkin, A.I., *J. Cryst. Growth,* 1999, vols. 198–199, part 1, p. 856.

[**ADS**](http://adsabs.harvard.edu/cgi-bin/nph-data_query?link_type=ABSTRACT&bibcode=1999JCrGr.198..856Z)**[Article](https://doi.org/10.1016/S0022-0248%2898%2901045-8) [Google Scholar](http://scholar.google.com/scholar_lookup?&title=&journal=J.%20Cryst.%20Growth&volume=198%E2%80%93199&publication_year=1999&author=Zaslavsky%2CB.G.&author=Grinyov%2CB.V.&author=Suzdal%2CV.S.&author=Kudin%2CA.M.&author=Kisil%2CI.I.&author=Vasetsky%2CS.I.&author=Mitichkin%2CA.I.)**

1. Zaslavskii, B.G., Grinev, B.V., Vasetskii, S.I., Kolesnikov, A.V., Kudin, A.M., Mitichkin, A.I., and Ovcharenko, N.V., RF Patent 87792, *Byull. Izobret.,* 2009, no. 15.
2. Vinograd, E.L., Goriletsky, V.I., Kovaleva, L.V., Korsunova, S.P., Kudin, A.M., Mitichkin, A.I., Panova, A.N., Protsenko, V.G., Shakhova, K.V., and Shpilinskaya, L.N., US Patent 5876630, 1999.
3. Didenko, A.V., *Cand. Sci. (Eng.) Dissertation,* Kharkiv: *Institute for Single Crystals*, Natl. Acad. Sci. of Ukraine, 2017.
4. Trefilova, L.N., Kudin, A.M., Kovaleva, L.V., Zaslavsky, B.G., Zosim, D.I., and Bondarenko, S.K., *Nucl. Instrum. Methods Phys. Res.,Sect. A,* 2002, vol. 486, p. 474. [https://doi.org/10.1016/S0168-9002(02)00756-8](https://doi.org/10.1016/S0168-9002%2802%2900756-8)

[**Article**](https://doi.org/10.1016/S0168-9002%2802%2900756-8)**[Google Scholar](http://scholar.google.com/scholar_lookup?&title=Nucl.%20Instrum.%20Methods%20Phys.%20Res.&journal=Sect.%20A&doi=10.1016%2FS0168-9002%2802%2900756-8&volume=486&publication_year=2002&author=Trefilova%2CL.N.&author=Kudin%2CA.M.&author=Kovaleva%2CL.V.&author=Zaslavsky%2CB.G.&author=Zosim%2CD.I.&author=Bondarenko%2CS.K.)**

1. Kudin, A.M., Borodenko, Yu.A., Belogub, V.V., and Didenko, A.V., *Bull. Natl. Tech. Univ. Khark. Polytech. Inst.,* 2014, no. 15 (1058), p. 87.
2. Shpilinskaya, A.L., Didenko, A.V., Zelenskaya, O.V., Andryushchenko, L.A., Kudin, A.M., and Muntyan, V.K., UA Patent 118246, *Byull. Izobret.,* 2018, no. 23.

[**Download references**](https://link.springer.com/article/10.1134/S0020441219060137-references.ris)

### Affiliations

1. **Institute of Scintillation Materials, National Academy of Sciences of Ukraine, 61001, Kharkiv, Ukraine**

A. L. Shpilinskaya, A. V. Didenko & O. V. Zelenskaya

1. **National University of Civil Defense of Ukraine, 61023, Kharkiv, Ukraine**

A. M. Kudin & L. A. Andryushchenko