

CURRICULUM VITAE



Name: Salih

Surname: Özbay

Date and Place of Birth: 18 September 1986, Istanbul, Turkey.

Marital Status: Single

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A - EDUCATION:

High School, Maltepe Anatolian High School, Istanbul, Turkey, (2001 – 2004).

Bachelor of Science, Department of Chemical Engineering, Ataturk University, Erzurum, Turkey, (2004 – 2008).

Master of Science, Department of Chemical Engineering, Gebze Institute of Technology, Gebze-Kocaeli/Turkey, (2008 – 2010), Thesis Title: “Solution addition polymerization of perfluoroacrylate, methyl methacrylate and butyl acrylate”, Thesis Supervisor: Prof. Dr. H. Yildirim Erbil.

Doctor of Philosophy, Department of Chemical Engineering, Gebze Technical University, Gebze-Kocaeli/Turkey, (2011 – 2015), Thesis Title: “Synthesis and characterization of anti-icing polymer coatings”, Thesis Supervisor: Prof. Dr. H. Yildirim Erbil.

B – WORK EXPERIENCE:

1- Assistant Professor, Sivas University of Science and Technology, Department of Chemical Engineering, Sivas/Turkey, (January 2020 –)

2- Technology Development Engineer, TUSAŞ - Turkish Aerospace Industries, Inc. (TAI), Ankara/Turkey, (October 2018 – January 2020)

3- Sales and Marketing Engineer, Alfa Chemistry Corporation, Istanbul/Turkey, (March 2018 – July 2018).

4- R&D Chemical Engineer, PETLAS Tire Industry and Trade Inc., Kırsehir/Turkey, (November 2017 – January 2018).

5- R&D Project Manager, Öztekt Textile Printing and Dyeing Industries Inc., Ergene-Tekirdag/Turkey, (April 2016 – September 2017).

6- Project Assistant – PhD student, TUBITAK-TBAG (Project No: 112T813) “Synthesis and characterization of anti-icing coatings made of porous polymer/impregnated liquid pair”, Gebze Technical University, Gebze-Kocaeli/Turkey, (April 2013 – April 2015), Project Manager: Prof. Dr. H. Yildirim Erbil

7- Project Assistant – PhD student, TUBITAK-MAG (Project No: 111M458), “Synthesis of a Superoleophobic Surface using Fluoro(meth)acrylate Polymers in Liquid-CO₂ Medium (Solvent-Free Process)”, Gebze Institute of Technology, Gebze-Kocaeli/Turkey, (November 2011 – November 2012), Project Manager: Prof. Dr. H. Yildirim Erbil

8- Project Assistant – MSc student, EC-FP6-Integrated Project, Advanced Nanostructured Surfaces for the Control of Biofouling (AMBIÖ), Gebze Institute of Technology, Gebze-Kocaeli/Turkey, (March 2009 – February 2010), Project Manager: Prof. Dr. H. Yildirim Erbil

C - Scientific Research Interests and R&D Activities:

1. Solution copolymerization of fluorinated monomers with commercial monomers.
2. Investigating the effect of monomer composition of fluorinated copolymers on molecular weight, glass transition temperature and surface free energy.
3. Surface free energy calculation of polymer surfaces using contact angle measurements.
4. Determination of Mark-Houwink constants of polymers.
5. Synthesis of polymeric superhydrophob and superoleophob surfaces in liquid CO₂.
6. Grafting of perfluoro acrylates onto SBR rubber and preparation of water/oil repellent surfaces by using organic/inorganic hybrid method.
7. Synthesis and characterization of anti-icing polymer coatings. Development of anti-icing characterization methods.
8. Production of ballistic armor plate using ceramic/polymer composites.
9. Development of textile products containing thermal energy storage properties with microcapsulation of phase change materials (PCM).

D - Publications in International Journals:

- D1.** Solution copolymerization of perfluoroalkyl ethyl methacrylate with methyl methacrylate and butyl acrylate: Synthesis and surface properties, **S. Ozbay** and H. Y. Erbil, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 452, 9-17, (2014).
- D2.** Superhydrophobic and oleophobic surfaces obtained by graft copolymerization of perfluoroalkyl ethyl acrylate onto SBR rubber, **S. Ozbay** and H. Y. Erbil, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 481, 537-546, (2015).
- D3.** Improved icephobic properties on surfaces with a hydrophilic lubricating liquid, **S. Ozbay**, C. Yuceel and H. Y. Erbil, *ACS Applied Materials & Interfaces*, 7, 22067-22077, (2015).
- D4.** Ice accretion by spraying supercooled droplets is not dependent on wettability and surface free energy of substrates, **S. Ozbay** and H. Y. Erbil, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 504, 210-218, (2016).
- D5.** Solvent-free synthesis of a superamphiphobic surface by green chemistry, **S. Ozbay**, U. Cengiz and H. Y. Erbil, *ACS Applied Polymer Materials*, 1 (8), 2033-2043, (2019).
- D6.** N. Erdogan, F. Erden, A.T. Astarlioglu, M. Ozdemir, **S. Ozbay**, G. Aygun, L. Ozyuzer, "ITO/Au/ITO multilayer thin films on transparent polycarbonate with enhanced EMI shielding properties", *Current Applied Physics*, 20, 489-497, (2020).

E - Papers Presented at Conferences:

- E1.** "Solution addition polymerization of perfluoroacrylate, methyl methacrylate and butyl acrylate", **Salih Özbay** and H. Yıldırım Erbil, 3rd National Polymer Science and Technology Congress, Kocaeli University, Kocaeli/Turkey, 12-14 May 2010.
- E2.** "Effect of monomer composition of fluorinated copolymers on glass transition temperature and surface free energy", **Salih Özbay** and H. Yıldırım Erbil, 10. National Chemical Engineering Congress, Koc University, Istanbul/Turkey, 3-6 September 2012.
- E3.** "Synthesis of superoleophobic surface in liquid CO₂ medium" Uğur Cengiz, **Salih Özbay** and H. Yıldırım Erbil, 4. National Polymer Science and Technology Congress, Canakkale 18 March University, Canakkale/Turkey, 5-8 September 2012.

- E4.** “Effect of wettability and surface free energy on icing” **Salih Özbay** and H. Yıldırım Erbil, 12. National Chemical Engineering Congress, Izmir Institute of Technology, Izmir/Turkey, 23-26 August 2016.
- E5.** “Synthesis of anti-icing polymer surface with hydrophilic liquid impregnated materials” **Salih Özbay** and H. Yıldırım Erbil, 12. National Chemical Engineering Congress, Izmir Institute of Technology, Izmir/Turkey, 23-26 August 2016.
- E6.** “Synthesis and characterization of anti-icing polymer coatings” **Salih Özbay** and H. Yıldırım Erbil, 6. National Polymer Science and Technology Congress, Hacettepe University, Ankara/Turkey, 4-7 September 2016.
- E7.** “Superhydrophobic and oleophobic surfaces obtained by perfluoroalkyl ethyl acrylate grafted SBR rubber and anti-icing properties” **Salih Özbay** and H. Yıldırım Erbil, 6. National Polymer Science and Technology Congress, Hacettepe University, Ankara/Turkey, 4-7 September 2016.
- E8.** “Transparent and Conductive ITO/Au/ITO Multilayer Thin Films with Enhanced EMI Shielding Properties”, Erdogan, N., Astarlioglu, A.T., **Ozbay, S.**, Erden, F., Ece, R.E., Ozdemir, M., Aygun, G., Ozyuzer L., International Conference on Advances in Functional Materials in UCLA (AAAFM-UCLA), University of California, Los Angeles, USA, August 19-22, 2019.

F – Selected International Citations:

- F.1.** Han, D.; Zhu, L.; Chen, Y.; Li, W.; Wang, X.; Ning, L., Synthesis of fluorosilicone monomer and application in hydrophobic surface of acrylic copolymer, *Journal of Applied Polymer Science*, 132, 41926, (2015), Cited Article: D1.
- F.2.** Yıldırım, M.; Demir, G.E.; Caglar, A.; Cengiz, U.; Kaya, I., Fabrication of superhydrophobic and highly oleophobic electrochromic composite surfaces, *Progress in Organic Coatings*, 97, 254 – 260, (2016), Cited Article: D1.
- F.3.** Gu, Z.; Zhang, M.; He, J.; Ni, P., Surface energy and surface reorganization of perfluorohexylethyl methacrylate/n-alkyl (meth)acrylate copolymers, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 502, 159 – 167, (2016), Cited Article: D1.
- F.4.** Gu, Z. Cheng, J.; Zhang, M.; He, J.; Ni, P., Effect of groups at α -position and side-chain structure of comonomers on surface free energy and surface reorganization of fluorinated methacrylate copolymer, *Polymer*, 114, 79 – 87, (2017), Cited Article: D1.

F.5. Bryuzgin, E.V.; Klimov, V.V.; Repin, S.A.; Navrotskiy, A.V.; Novakov, I.A. Aluminum surface modification with fluoroalkyl methacrylate-based copolymers to attain superhydrophobic properties, *Applied Surface Science*, 419, 454-459, (2017), Cited Article: D1.

F.6. Darmanin, T.; Laugier, J.P.; Orange, F.; Guittard, F., Influence of the monomer structure and electrochemical parameters on the formation of nanotubes with parahydrophobic properties (high water adhesion) by a templateless electropolymerization process, *Journal of Colloid and Interface Science*, 466, 413-424, (2016), Cited Article: D2

F.7. Godeau, G.; Darmanin, T.; Guittard, F., Hydrocarbon/perfluorocarbon mixed chain azides for surface post-functionalization, *Journal of Fluorine Chemistry*, 184, 8 – 15, (2016), Cited Article: D2.

F.8. Boo, C.; Lee, J.; Elimelech, M., Omniphobic polyvinylidene fluoride (PVDF) membrane for desalination of shale gas produced water by membrane distillation, *Environmental Science & Technology*, 50 (22), 12275 – 12282, (2016), Cited Article: D2.

F.9. Demir, T.; Wei, L.; Nitta, N.; Yushin, G.; Brown, P.J.; Luzinov, I., Towards a long-chain perfluoroalkyl replacement: Water and oil repellency of polyethylene terephthalate (PET) films modified with perfluoropolyether-based polyesters, *ACS Applied Materials & Interfaces*, 9 (28), 24318 – 24330, (2017), Cited Article: D2.

F.10. Liu, B.; Zhang, K.; Tao, C.; Zhao, Y.; Li, X.; Zhu, K.; Yuan, X., Strategies for anti-icing: low surface energy or liquid-infused?, *RSC Advances*, 6, 70251 – 70260, (2016), Cited Article: D3.

F.11. Moriya, T.; Manabe, K.; Tenjimabayashi, M.; Suwabe, K.; Tsuchiya, H.; Matsubayashi, T.; Navarrini, W.; Shiratori, S., A superrepellent coating with dynamic fluorine chains for frosting suppression: effects of polarity, coalescence and ice nucleation free energy barrier, *RSC Advances*, 6 (95), 92197 – 92205, (2016), Cited Article: D3.

F.12. Bazyar, H.; Javadpour, S.; Lammertink, R.G.H., On the gating mechanism of slippery liquid infused porous membranes, *Advanced Materials Interfaces*, DOI: 10.1002/admi.201600025, (2016), Cited Article: D3.

F.13. Godeau, G.; Guittard, F.; Darmanin, T., Staudinger-Ureation: A new and fast reaction for surface post-functionalization, *Materials Today Communications*, 8, 165 – 171, (2016), Cited Article: D3.

- F.14.** Yeong, Y. H.; Wang, C.; Wynne, K.J.; Gupta, M.C., Oil-infused superhydrophobic silicone material for low ice adhesion with long-term infusion stability, *ACS Applied Materials & Interfaces*, 8 (46), 32050 – 32059, (2016), Cited Article: D3.
- F.15.** Sun, X.; Rykaczewski, K., Suppression of frost nucleation achieved using the nanoengineered integral humidity sink effect, *ACS Nano*, 11, 906 – 917, (2017), Cited Article: D3.
- F.16.** Chen, D.; Gelenter, M.D.; Hong, M.; Cohen, R.E.; McKinley, G.H., Icephobic surfaces induced by interfacial nonfrozen water, *ACS Applied Materials & Interfaces*, 9 (4), 4202 – 4214, (2017), Cited Article: D3.
- F.17.** Tao, C.; Li, X.; Liu, B.; Zhang, K.; Zhao, Y.; Zhu, K.; Yuan, X., Highly icephobic properties on slippery surfaces formed from polysiloxane and fluorinated POSS, *Progress in Organic Coatings*, 103, 48 – 59, (2017). Cited Article: D3.
- F.18.** Zhang, J.; Gu, C.; Tu, J., Robust Slippery Coating with Superior Corrosion Resistance and Anti-Icing Performance for AZ31B Mg Alloy Protection, *ACS Applied Materials & Interfaces*, 9 (12), 11247 – 11257, (2017), Cited Article: D3.
- F.19.** Chen, J.; Li, K.; Wu, S.; Liu, J.; Liu, K.; Fan, Q., Durable anti-icing coatings based on self-sustainable lubricating layer, *ACS Omega*, 2 (5), 2047 – 2054, (2017), Cited Article: D3.
- F.20.** Li, C.; Li, X.; Tao, C.; Ren, L.; Zhao, Y.; Bai, S.; Yuan, X., Amphiphilic Antifogging/Anti-Icing Coatings Containing POSS-PDMAEMA-b-PSBMA, *ACS Applied Materials & Interfaces*, DOI: 10.1021/acsami.7b05286, (2017), Cited Article: D3..
- F.21.** Zhang, W.; Wang, S.; Xiao, Z.; Yu, X.; Liang, C.; Zhang, Y., Frosting Behavior of Superhydrophobic Nanoarrays under Ultralow Temperature, *Langmuir*, DOI: 10.1021/acs.langmuir.7b01418, (2017), Cited Article: D3.
- F.22.** Tao, C.; Li, X.; Liu, B.; Zhang, K.; Zhao, Y.; Zhu, K.; Yuan, X., Highly icephobic properties on slippery surfaces formed from polysiloxane and fluorinated POSS, *Progress in Organic Coatings*, 103, 48 – 59, (2017). Cited Article: D4.
- F.23.** Zhang, G.; Zhang, Q.; Cheng, T.; Zhan, X.; Chen, F., Polyols-Infused Slippery Surfaces Based on Magnetic Fe₃O₄-Functionalized Polymer Hybrids for Enhanced Multifunctional Anti-Icing and Deicing Properties, *Langmuir*, 34 (13), 4052 – 4058, (2018). Cited Article: D4.

G – Abstract of Doctoral Thesis

Thesis Title: Synthesis and Characterization of Anti-icing Polymer Coatings

Thesis Supervisor: Prof. Dr. H. Yildirim Erbil.

Icing adversely affects airplanes, ships, wind turbines and telecommunication antennas which are infrastructure of the modern life. In this study, we investigated the anti-icing properties of various solvent impregnated rubber, PP-fiber and cellulose based filter paper surfaces and also aluminium and PTFE surfaces which were selected as reference materials by using ice accretion, ice adhesion strength and drop freezing time methods. Supercooled droplets were sprayed in an environmental chamber to determine the weight increase of formed ice on the surface. Superhydrophobic surfaces were prepared with perfluoroalkyl ethyl acrylate grafted SBR rubber after addition of fumed silica powders. Anti-icing tests were also applied to these superhydrophobic surfaces. Surface free energy values of the reference materials were calculated by using contact angle results, relationship between surface free energy and anti-icing properties of the surfaces was investigated. It was found that ice adhesion strength decreased from 1217 kPa to 268 kPa and ice formation time increased from 40 s to 315 s with increase of equilibrium contact angle from 75° to 105° and with decrease of surface free energy from 39.2 mJ/m² to 21.8 mJ/m². It was found that ice accretion on surfaces impregnated with hydrogen bonding solvents such as glycerine, formamide and ethylene glycol were substantially lower than other solvent impregnated surfaces and solid reference surfaces. The best performance was determined for glycerin impregnated filter paper at -2 °C, where ice accretion was 64 % lower than that of reference PTFE and 70 % lower than that of aluminum surfaces.

H – Abstract of Master's Thesis

Thesis Title: Solution Addition Polymerization of Perfluoroacrylate, Methyl methacrylate and Butyl acrylate

Thesis Supervisor: Prof. Dr. H. Yildirim Erbil.

Solution polymerization is a technique which monomers can be polymerized in a solvent or a solvent mixture and this polymerization technique provides a means to overcome viscosity-related problems such as those encountered in the areas of heat transfer, mixing and product processing. Fluoro-polymers have widespread applications in modern technologies because of water repellency properties, ranging from building, textile, automotive, aerospace industries

to optics and microelectronics. In this study, we investigated solution copolymerization of perfluoroalkylethyl methacrylate (Zonyl-TM) monomers with methyl methacrylate (MMA) and butyl acrylate (BuA) monomers. AIBN was used as a initiator and synthesis of statistical terpolymers and copolymers in toluene and mixtures of toluene and methyl ethyl ketone. Intrinsic viscosity values were determined by Ubbelohde viscosimetry by using toluene at 25 °C. Molecular weight of the polymers were determined by GPC. Chemical structure of copolymers were characterized by H-NMR and T_g values were determined by DSC. Afterwards, thin films were prepared by dip coating glass slide in copolymers solutions and surface properties were investigated by contact angle measurement and optical microscopy. T_g values were decreased with increasing Zonyl-TM in the copolymer structure because of increasing the free volume of the copolymer. Water contact angle of the sample surfaces increased by increasing with the feed of the Zonyl-TM amount, ranging from 78° to 119°. At the same time, the surface free energy of the surfaces were calculated by using Owens Wendt and Van Oss Good methods. According to the calculated values, surface free energy of surfaces decreased from 40,60 to 10,54 mN/m with increasing the fluorine content.

I – Vocational Education and Certificates:

1. “**Calibration and Measurement Uncertainties**”, Bureau Veritas, Öztekt Textile Printing and Dyeing Industries Inc., Ergene-Tekirdag/Turkey, 20.07.2016 – 21.07.2016.
2. “**ISO 27001:2013 Information Security Management System**”, Bureau Veritas, Öztekt Textile Printing and Dyeing Industries Inc., Ergene-Tekirdag/Turkey, 25.07.2016 – 26.07.2016.
3. “**ISO 27001:2013 Information Security Management System Internal Auditor**”, Bureau Veritas, Öztekt Textile Printing and Dyeing Industries Inc., Ergene-Tekirdag/Turkey, 01.08.2016 – 02.08.2016.

J – Memberships:

1. UCTEA (Union of Chambers of Turkish Engineers and Architects) – Chamber of Chemical Engineers
2. Gebze Technical University Alumni Association