

## ZEINAB SANAEE

### PERSONAL INFORMATION

**Name:** Zeinab Sanaee

**Date of birth:** 17 Sept. 1983

**Office:** No.408, ECE new building, University of Tehran

**Address:** School of Electrical and Computer Engineering, College of Engineering, University of Tehran, North Kargar st., Tehran, Iran.

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### PROFESSIONAL CARRIER

Assistant professor in Electrical and Computer Engineering Department, University of Tehran, Tehran, Iran, 2012-present.

Director of “Nano-fabricated Energy Devices” laboratory, 2014-present

(Lab Webpage: <http://ned-lab.ir/>)

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### EDUCATION

#### **PHD (ELECTRICAL ENGINEERING-UNIVERSITY OF TEHRAN)**

[2009-2011]

Thesis Title: Investigation and fabrication of silicon micro and nano needles using deep micromachining technique.

Supervisor: Prof. Mohajerzadeh

#### **M.SC. (ELECTRICAL ENGINEERING-UNIVERSITY OF TEHRAN)**

[2007-2009]

Thesis Title: Design and fabrication of flexible plasma panels on PET

Supervisor: Prof. Mohajerzadeh

#### **B.SC. (ELECTRICAL ENGINEERING-UNIVERSITY OF TEHRAN)**

[2003-2007]

Thesis Title: Fabrication of carbon nanotube display

Supervisor: Prof. Mohajerzadeh

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## HONORS

- One of the selected teams in “Nano-Battery-Challenge”, 2017
- Distinguished Teaching Award, Department of Electrical and Computer Engineering, University of Tehran, 2014.
- Best Poster award, EMRS- Fall meeting, Warsaw, Poland, 2012.
- Ranked 1st among PhD. admitted students in Electrical Engineering, University of Tehran, 2007.
- Ranked 1st among PhD. admitted students in Nano-Electronics, University of Tehran, 2007.
- 1st GPA among all M.Sc. students of the whole Engineering Department, University of Tehran, 2007.
- Winner of Khwarizmi International Award and ranked 2nd, 2007.
- Ranked 1st among M.Sc. admitted students in Electrical engineering, University of Tehran, 2005.
- Ranked 1st among B.Sc. admitted students in Electrical engineering, University of Tehran, 2001
- Being as one of the exceptional talent students in University of Tehran for 6 years (B.Sc. and M.Sc.), [2001-2007]
- Ranked 88th among 400,000 candidates participating in the B.Sc. entrance exam, 2001

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## RESEARCH INTERESTS

- Nano/Micro Fabricated Energy Devices (Li Ion Batteries, Super-Capacitors, Fuel Cells, Solar Cells, Energy Harvesting Devices,..)
- Fabrication of Scalable Li ion batteries (Si Nano-structure based anode, NCM cathode, LiFePo<sub>4</sub> cathode,..)
- NEMS/MEMS Fabrication Technology
- Hybrid Energy Devices

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## PATENT

- US Patent, NO: 8956820, S. Mohajerzadeh, M. Abdolahad, Z. Sanaee and M. Abdollahi, “High efficiency Cancer cell detection using vertically aligned carbon nanotube”, 2015.

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## RESEARCH PROJECTS

- “Fabrication of Lithium batteries using Carbon nano-structures”, **INSF**, 2015.
- “Design and fabrication of high performance batteries and super-capacitors using nano/micro technologies”, **Niroot Research Center**, 2017.

### Journal papers

- [1] H. Abdollahi, M. Samkan, M. A. Mohajerzadeh, Z. Sanaee, S. Mohajerzadeh, "Fabrication and investigation of high performance CNT-incorporated tin-oxide supercapacitor," *Journal of Materials Science: Materials in Electronics*, Volume 29, Issue 9, pp 7468–7479, 2018.
- [2] F. Ghasemi, M. Jalali, A. Abdollahi, S. Mohammadi, Z. Sanaee and S. Mohajerzadeh, "A High Performance Supercapacitor Based on Decoration of MoS<sub>2</sub>/Reduced Graphene Oxide with NiO Nanoparticle," *RSC Advances*, Vol 7, pp. 52772, 2017.
- [3] Z. Sanaee, A. Abnavi, M. Sadati Faramarzi, S. Ghasemi, "SnO<sub>2</sub> nanowires on carbon nanotube film as a high performance anode material for flexible Li-ion batteries," accepted in *Nanostructures*, 2017.
- [4] A. Abnavi, M. Sadati Faramarzi, A. Abdollahi, R. Ramezani, S. Ghasemi and Z. Sanaee, "SnO<sub>2</sub>@a-Si core-shell nanowires on free-standing CNT paper as a thin and flexible Li-ion battery anode with high areal capacity," *Nanotechnology*, Vol 28, pp. 255404, 2017.
- [5] S.A. Safiabadi Tali, S. Soleimani-Amiri, Z. Sanaee and S. Mohajerzadeh, "Nitrogen-doped amorphous carbon-silicon core-shell structures for high-power supercapacitor electrodes," *Scientific Reports* 7, Article number: 42425, 2017.
- [6] S. Sepahvand, S. Ghasemi, Z. Sanaee, "Electric Field Enhanced Synthesis of Copper Hydroxide Nano-Structures for Supercapacitor Application," *Journal of Nano, NANO*, Vol. 12, No. 1, pp. 1750010, 2017.
- [7] A. Mashayekhi, S.M. Hosseini, M. Hassanpour Amiri, N. Namdar and Z. Sanaee, "Plasma-assisted nitrogen doping of VACNTs for efficiently enhancing the supercapacitor performance", *Journal of Nanoparticle Research*, vol 18, p. 154, 2016.
- [8] M. Hassanpour Amiri, N. Namdar, A. Mashayekhi, F. Ghasemi, Z. Sanaee, S. Mohajerzadeh, "Flexible micro supercapacitors based on laser-scribed graphene/ZnO nanocomposite" *Journal of Nanoparticle Research*, 2016.
- [9] S Soleimani-Amiri, S Zanganeh, R Ramzani, R Talei, S Mohajerzadeh, S Azimi and Z Sanaee, "3D micro- and nano-machining of hydrogenated amorphous silicon films on SiO<sub>2</sub>/Si and glass substrates," *J. Micromech. Microeng.*, vol. 25, pp. 074004, 2015.

- [10] S.M. Hosseini, A. Mashayekhi, S. Mohajerzadeh, Z. Sanaee, "A Facile Solution Based Nickel Deposition Method for the Formation of Vertically Aligned Carbon Nanotubes," *Modares Journal of Electrical Engineering (MJEE)*, VOL. 13, NO. 3, pp. 41-46, 2016.
- [11] S.M. Hosseini, S.A. Safiabadi Tali, Z. Sanaee, "Carbon Nanotubes on ITO/Silicon Substrate for Fabrication of Silicon Based Lithium Ion Battery," *Modares Journal of Electrical Engineering (MJEE)*, VOL. 13, NO. 3, pp. 35-39, 2016.
- [12] S. Sepahvand, P. Safaei, Z. Sanaee, "Growth of Carbon Nano Tubes on Copper Substrate Suitable for Lithium Ion Battery Anode," *Procedia Materials Science*, Volume 11, Pages 634–638, 2015.
- [13] S. Soleimani-Amiri, S.A. Safiabadi Tali, S. Azimi, Z. Sanaee, S. Mohajerzadeh, "Highly featured amorphous silicon nanorod arrays for high-performance lithium-ion batteries," *Applied Physics Letters*, Volume 105, Issue 19, 2014.
- [14] S. Soleimani Amiri, A. Gholizadeh, S. Rajabali, Z. Sanaee, S. Mohajerzadeh, "Formation of Si nanorods and hollow nano-structures using high precision plasma-treated nanosphere lithography," *RSC Adv.*, 4, 12701-12709, 2014.
- [15] M. Poudineh, Z. Sanaee, A. Gholizadeh, S. Soleimani, S. Mohajerzadeh, "Formation of Highly Ordered Silicon Nanowires by a High-Speed Deep Etching," *IEEE Transactions on Nanotechnology*, Volume 12, no.5, pp.712-718, 2013.
- [16] M. Abdolahad, Z. Sanaee, M. Janmaleki, S. Mohajerzadeh, M. Abdollahi, M. Mehran, "Vertically aligned multiwall-carbon nanotubes to preferentially entrap highly metastatic cancerous cells," *Journal of CARBON*, Volume 50, Issue 5, pp. 2010-2017, 2012.
- [17] A. Gholizadeh, S. Shahrokhian, A. Irajizad, S. Mohajerzadeh, M. Vosoughi, S. Darbari, Z. Sanaee, "Mediator-less highly sensitive voltammetric detection of glutamate using glutamate dehydrogenase/vertically aligned CNTs grown on silicon substrate," *Biosensors and Bioelectronics*, Volume 31, Issue 1, Pages 110-115, 2012.
- [18] Z. Sanaee, M. Poudineh, M. Abdolahad and S. Mohajerzadeh, "High aspect ratio micro- and nano-machining of silicon using time-multiplexed reactive ion etching," *Journal of micromachining and microengineering*, Volume 21, 125012 (11pp), 2011.
- [19] Z. Sanaee, S. Mohajerzadeh and M. Mehran, "A self-defined hollow needle formation on Silicon membranes with the aids of carbon nanotubes," *Journal of Nanoscience and Nanotechnology*, Volume 11, Number 10, pp. 8786-8791(6), 2011.

- [20] Z. Sanaee, S. Mohajerzadeh, K. Zand, F. S. Gard and H. Pajouhi, "Minimizing permeability of PET substrates using Oxygen plasma treatment," *Journal of Applied Surface Science*, Volume 96, Issue 20, pp. 2218-2225, 2011.
- [21] Z. Sanaee and S. Mohajerzadeh, "Ultrafine hollow needle formation on silicon," *Journal of Applied Physics*, Volume 107, Issue 8, pp. 083711-1 to 083711-6, 2010.
- [22] Z. Sanaee, K. Zand, S. Mohajerzadeh and F. S. Gard, "Improved permeability of PET substrates using oxygen and hydrogen Plasma," *Journal of Vacuum*, Volume 85, pp 290-296, 2010.
- [23] M. Mehran, Z. Sanaee and S. Mohajerzadeh, "Formation of silicon nano-grass and nano-structures on silicon using a deep reactive ion etching", *Journal of Micro & Nano Letters*, Volume 5, Issue 6, pp. 374-378, 2010.
- [24] M. Mehran, S. Mohajerzadeh, Z. Sanaee and A. Abdi, "Nanograss and nanostructure formation on silicon using a modified deep reactive ion etching", *Journal of Applied Physics Letters*, Volume 96, Issue 20, pp. 203101-1 to 203101-3, 2010.
- [25] M. Mehran, Z. Sanaee, M. Abdolahad and S. Mohajerzadeh, "Controllable silicon nano-grass formation using a hydrogenation assisted deep reactive ion etching," accepted in *Journal of Materials Science in Semiconductor Processing*, vol 14, pp. 199–206, 2011.
- [26] M. Mehran, Z. Kolahdouz, Z. Sanaee and S. Mohajerzadeh, "Evolution of high aspect ratio and nano-grass structures using a modified low plasma density reactive ion etching," accepted in *The European Physical Journal Applied Physics*, vol. 55, pp. 11302, 2011.
- [27] H. Pajouhi, S. Mohajerzadeh, F. Nayeri and Z. Sanaee, "Deep micromachining of Poly-ethylene Terephthalate for plastic MEMS applications," *Journal of Solid State Electronics*, Volume 54, Issue 12, pp. 1536-1542, 2010.
- [28] Y. Abdi, J. Koohsorkhi, S. Mohajerzadeh, S. Darbari, and Z. Sanaee, "Embedded vertically grown carbon nanotubes for field emission applications," *Journal of Vacuum Science & Technology B*, Volume 25, Issue 3, pp. 822-828, 2007.

### **Conference papers**

- [1] A Abnavi, M S. Faramarzi, S Ghasemi, Z Sanaee, "A flexible free-standing carbon nanotube paper as a binder-free anode for lithium-ion

- battery,” International Conference on Fundamental Research in Electrical Engineering, Tehran, Iran, 2017.
- [2] S. Najafi, Z. Sanaee and S. Ghasemi, Synthesis of Nano and Micro Structures of Cobalt Oxide, Suitable for Supercapacitor Application,” 4th international Conference on Electrical and Computer Engineering Tehran, Iran, 2017.
- [3] A. Abnavi, S. Ghasemi and Z. Sanaee, “Fabrication of free-standing reduced Graphene Oxide thin film for flexible, high performance Energy Storage Devices, Innovations in Electrical and Computer Engineering, Tehran, Iran, 2016.
- [4] S. M. Sadati Faramarzi and Z. Sanaee, “Large-scale Synthesis of SnO<sub>2</sub> Microspheres for Use as Li-ion Battery Anode Material,” 5th International Conference on Nanotechnology, Turkey, 2016.
- [5] S. Adnani, M. Mashayekhi, Z. Sanaee, “PVdF membrane as a gel polymer electrolyte for Lithium ion batteries,” 5th International Conference on Nanotechnology, Turkey, 2014.
- [6] S. M. Sadati Faramarzi and Z. Sanaee, “Synthesis of SnO<sub>2</sub> Nanospheres Suitable for Li-ion Battery Anodes,” The 4th Nano Technology Conference in Power and Energy, Tehran, Iran, 2016.
- [7] S. Adnani, M. Mashayekhi, S. Ghasemi, Z. Sanaee, “Fabrication of Deep Brain Stimulation Probe and ZnO Nano rod based Lithium Ion Battery for Its Power Supply,” 5th International Biennial Conference on Ultrafine Grained and Nanostructured Materials (UFGNSM15), Tehran, Iran, 2015. (This poster obtained the 2<sup>nd</sup> rank in the best poster competition.)
- [8] S. Sepahvand, P. Safaei, Z. Sanaee, “Growth of Carbon Nano Tubes on Copper Substrate Suitable for Lithium Ion Battery Anode,” 5th International Biennial Conference on Ultrafine Grained and Nanostructured Materials (UFGNSM15), Tehran, Iran, 2015.
- [9] S. M. Sadati Faramarzi and Z. Sanaee, “Fabrication of Silicon Nanowires Suitable for Lithium Ion Battery Anode Material”, 23rd Iranian Conference on Electrical Engineering (ICEE2015), Tehran, Iran, 2015.
- [10] S. Sepahvand and Z. Sanaee, “Fabrication of Copper Oxide Nano-Rods on Copper Substrate and Its Application as Lithium Ion Battery Anode Material,” 10th International Energy Conference, Iran, 2014.
- [11] S.M. Hosseini, S.A. Safiabadi Tali, and Z. Sanaee, “Growth of Carbon Nanotubes on Silicon Wafer with ITO Barrier Layer Suitable as Lithium Ion Battery Anode Material,” 10th International Energy Conference, Iran, 2014.

- [12] S. Sepahvand and Z. Sanaee, "Growth of Carbon Nanotubes on Copper Substrate Suitable for Energy Devices," 2nd International Conference on Nanotechnology, Turkey, 2014.
- [13] S. Soleimani Amiri, S. Rajabali, A. Gholizadeh, Z. Sanaee, S. Mohajerzadeh, "Plasma-modified polystyrene Nanosphere Lithography for the formation of Silicon Nanopillars and vertical Nanotubes," 2nd International Conference on Nanotechnology, Turkey, 2014.
- [14] A. Safiabadi Tali, A. Mashaieki, M. Sadati Faramarzi, Z. Sanaee, "Fabrication of Aligned Carbon Nanotubes on Copper Substrate Using PECVD and Its Application as Anode in Lithium Ion Battery," International Conference on Nano-Structures (ICNS), Iran, 2014.
- [15] N. Bakhshaei, M. Mohammadi, A. Mashaieki, A. Safiabadi Tali, Z. Sanaee, "Fabrication of Silicon Neural Probe and Carbon Nano tube based Lithium Ion Battery for Its Power Supply," International Conference on Nano-Structures(ICNS), Iran, 2014.
- [16] S. Taak, S. Rajabali, S. Darbari, M. Poudineh, Z. Sanaee, and S. Mohajerzadeh, "Planting of Carbon Nanotubes on Nano-Textured and Micro-Structured Silicon Substrates," ECS Transactions, Volume 45, Issue 20, pp. 57-62, 2013.
- [17] Z. Sanaee, M. Mehran, and S. Mohajerzadeh, "Fabrication and Modeling of Silicon Micro-needles Suitable for Inclination Sensing," E-MRS Fall meeting, Warsaw, Poland, 2012. (This poster was awarded "Best Poster Award" in E-MRS 2012, Symposium H.)
- [18] Z. Sanaee, M. Poudineh and S. Mohajerzadeh, "Fabrication of silicon nano-needles suitable for biological applications," E-MRS Fall meeting, Warsaw, 2012.
- [19] Z. Sanaee, M. Poudineh, and S. Mohajerzadeh High precision high rate silicon etching process for nano – fabrication, MME, Germany, 2010.
- [20] Z. Sanaee, S. Mehrvarz, M. Mehran, S. Mohajerzadeh, "Fabrication of a Novel Hollow Micro Needles for Biological Applications," MRS Spring meeting, USA, 2011.
- [21] Z. Sanaee, S. Mohajerzadeh, M. Abdolhad, F. S. Gard, "Low Power Plasma Treatment of PET Substrates to Achieve Nano/Micro Structures," MRS Spring meeting, USA, 2011.
- [22] Z. Sanaee, M. Poudineh, M. Mehran and S. Mohajerzadeh, "High-aspect-ratio deep Si etching of micro/nano scale features with SF<sub>6</sub>/H<sub>2</sub>/O<sub>2</sub> plasma, in a low plasma density reactive ion etching system," NSTI, USA, 2011.

- [23] Z. Sanaee, M. Poudineh, M. Mehran and S. Mohajerzadeh, "Development of a novel technique for Silicon vertical etching in micro/nano scale with SF<sub>6</sub>/H<sub>2</sub>/O<sub>2</sub> plasma and in low plasma density," ICEE, Iran, 2011.
- [24] Z. Sanaee and S. Mohajerzadeh, "Novel ultra-fine hollow needles formed on Silicon membranes," presented at NSTI, pp. 484-487, USA, 2010.
- [25] Z. Sanaee and S. Mohajerzadeh, "Application of Silicon micro-needles in liquid based sensors and vapor transport," presented at MME, pp. 247-249, The Netherlands, 2010.
- [26] Z. Sanaee, S. Mohajerzadeh, "Ultrafine Silicon Nano-wall Hollow Needles and Applications in Inclination Sensor and Gas Transport," presented at MRS Fall meeting, Proceeding Volume 1299, USA, 2010.
- [27] Z. Sanaee and S. Mohajerzadeh, "Fabrication of Silicon needle-like structures suitable for controlled gas permeability," presented at ECS, Volume 33, Issue 8, pp. 171-174, Las Vegas, USA, 2010.
- [28] S. Mohajerzadeh, M. Mehran and Z. Sanaee, "Highly controllable Nano-texturing of silicon using hydrogen assisted Reactive Ion Etching", MRS Spring meeting, Proceeding Volume 1258, USA, 2010.
- [29] Z. Sanaee, M. Mehran, S. Mohajerzadeh, "Deep reactive ion etching to realize Silicon Nano and Micro Needles and Nanostructures," presented at International Semiconductor Device Research Symposium (ISDRS), USA, 2009.
- [30] Z. Sanaee, S. Mohajerzadeh, K. Zand, F. S. Gard and H. Pajouhi, "The Effect of Plasma Treatment on the Permeability of PET Substrates," presented at International Semiconductor Device Research Symposium (ISDRS), USA, 2009.
- [31] Z. Sanaee, S. Mohajerzadeh, H. Miladi, "Miniaturized Homopolar Rotating Liquid Device on Si substrates," presented at International Semiconductor Device Research Symposium (ISDRS), USA, 2009.
- [32] Z. Sanaee, M. Mehran and S. Mohajerzadeh, "Fabrication of Silicon and Carbon Nanotube-based hollow needles using a hydrogen-stimulated deep reactive ion etching," MNC, Japan, 2009.
- [33] Z. Sanaee, M. Mehran and S. Mohajerzadeh, "A self-defined hollow needle formation on Silicon membranes with the aids of carbon nanotubes," NANOSMAT, Rome, Italy, 2009.
- [34] M. Mehran, Z. Sanaee and S. Mohajerzadeh, "Highly controllable silicon nano-grass and nano-wire formation using a

- hydrogenation assisted deep reactive ion etching,” NANOSMAT, Rome, Italy, 2009.
- [35] M. Mehran, Z. Sanaee and S. Mohajerzadeh, "Silicon nano-grass and nanowires on silicon substrates using high precision reactive ion etching", presented at NS, Kish, Iran, 2010.
- [36] H. Pajouhi, S. Mohajerzadeh, F. Nayeri, F. Parsinejad, Z. Sanaee, "Deep micromachining of poly-ethylene terephthalate for plastic MEMS applications," presented at International Semiconductor Device Research Symposium (ISDRS), USA, 2009.
- [37] M. Mehran, Z. Sanaee and S. Mohajerzadeh, "Highly controllable silicon nano-grass and nano-wire formation using a hydrogenation assisted deep reactive ion etching," MNC, Japan, 2009.
- [38] Z. Sanaee, K. Zand, P. Saber and S. Mohajerzadeh, "Applying oxygen plasma on PET in order to reduce gas penetration in below atmosphere devices," presented at Third National Vacuum Conference, Sharif University, Tehran, Iran, 2008.
- [39] Z. Sanaee, K. Zand, S. Mohajerzadeh, N. Zehforoush, S. Darbari and A. Akhavan, "Realization of flexible lateral pixels on PET substrates for DC-PDP structures," Eurodisplay, pp. 421-424, Russia, 2007.
- [40] S. Haji, R. S. Tarighat, Z. Sanaee, S. Mohajerzadeh, M. Esfahani and A. Goodarzi, "Lateral hollow cathode pixel structure to realize DC plasma displays," presented at International Display Research Conference, USA, 2006.
- [41] Z. Sanaee, A. Goodarzi, S. Mohajerzadeh, A. Agah, and N. Zehforoush, "Fabrication of flexible plasma display panels on PET substrates," presented at Iranian conference on electrical Engineering (ICEE), pp. 122-126, Iran, 2007.
- [42] Z. Sanaee, S. Darbari, J. Koohsorkhi, A. Ebrahimi, S. Mohajerzadeh and Y. Abdi, "PECVD-grown vertically aligned carbon nanotubes on silicon substrates, utilized to realize a preliminary display," ICEE, Iran, 2006.
- [43] Y. Abdi, J. Koohsorkhi, Z. Sanaee, S. Mohajerzadeh, A. Ebrahimi and A. Khodadadi, "Embedded Carbon Nanotubes suitable for the realization of field emission transistors and displays," Carbon, Scotland, 2006.

## TEACHING EXPERIENCE

- Energy devices
  - Electronics I
  - Physics of electronic devices
  - Fabrication Laboratory
  - Electronics I Laboratory
  - M.Sc. Seminar
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## QUALIFICATIONS

- Experienced in fabrication of MEMS/NEMS devices.
  - Experienced in CNT growth, silicon nano grass formation, vertical etching of Silicon, plasma treatment of PET.
  - Experienced in different semiconductor procedures and clean room works such as deposition (RF sputtering, Evaporation, E-beam, RF PECVD, DC PECVD), DRIE, lithography, etching and etc.
  - Experienced in working with SEM.
  - Familiar with characterization instruments (such as FTIR, XPS, Raman, XRD, ..)
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## RESEARCH EXPERIENCE

- Fabrication of Lithium Ion battery with nano-structured anode material
  - Fabrication of Silicon neural micro probe
  - Fabrication of ultra-fine hollow needles formed on Silicon membranes
  - Development of a novel deep reactive ion etching process suitable for silicon etching in nanometric scale.
  - Nano-grass formation on silicon substrates using hydrogen assisted deep reactive ion etching
  - Fabrication of flexible plasma display on PET substrate
  - PET air penetration improvement (one of its applications: vacuum maintaining for flexible displays)
  - Fabrication of field emission CNT display on glass substrate
  - Fabrication of optical mask reduction set up
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