Zhar Research's New Report on 6G Communications: Optical Materials Opportunities

Tuesday 19 December, 2023

A unique new 355-page report identifies your huge optical material and component opportunities from 6G Communications as it becomes primarily an optical system – "6G Communications: Optical Materials and Components Markets: Visible, Near IR, Far IR from 0.3THz 2023-2043". It is a drill down from the overview report on 6G called, "6G Communications: Materials and Components Markets 2023-2043".

The new report answers such questions as:

- Why can the massive hardware expense of 6G only be justified by the ubiquity at stellar performance that comes from optics?
- Why will there be so many added value opportunities for your expertise in silicas, graphene, aluminas including sapphire, 3-5 compounds, silicon nitride, chalcogenides?
- What new forms with premium pricing? What else?
- What materials are trending down with the advent of 6G?
- Why does the first 6G phase from 2030 need massive amounts of fiber optics and some optical wireless communication? When?
- Why will the second 6G phase be necessary to achieve the promised ubiquitous stellar performance?
- Why will that have to be primarily with optics from 0.3THz far infrared to UV? When?
- Huge new markets for THz cable, reconfigurable intelligent surfaces, long-distance optical wireless transmission hardware, photovoltaic 6G drones, deep fiber optics, optically powered and optically communicating client devices? Why? When? What else?
- Detailed 20-year forecasts, roadmaps, new infograms and SOFT appraisals?

This report starts with a detailed glossary and listing of 96 of the companies mentioned. The Executive Summary and Conclusions is an easy read for those in a hurry. Its 58 pages contain the necessary explanations, new infograms, opportunity identification, leading players, SOFT appraisals, roadmaps and 17 forecasts all 2023-2043. No equations. No nostalgia.

The 23-page Introduction then explains our rationale, coverage and key issues. See the severe limitations of the various candidate technologies that must be overcome – not uncritical enthusiasm. Understand why optical wireless communication must become commonplace in 6G systems and that includes overcoming the Terahertz gap of inadequate materials and device performance at far infrared (above 0.3THz). Here are the vital photovoltaic and other optical material manufacturing technologies involved with more on both later in the report.

Chapter 3 "6G Optical Wireless Communication OWC" runs to 45 pages despite the analysis being condensed into many tables and images, including 32 participants analysed by country. We cover everything from satellite-to-client device, LiFi, lessons from limited use of OWC in 5G and why it will be a key enabling technology for 6G, component and frequency choices emerging from the research pipeline, choice of solar aerospace vehicles from satellites to upper atmosphere drones, lower-level solar drone swarming. A major focus in optical carrier attenuation modes and what to do about them, including a detailed look at effects of weather and frequency choices. We predict at least tenfold improvements in range and quality of service, including underwater and aerospace-to-earth. Considerable commercial opportunity is identified. See the materials and formats of next emitters and detectors including DFB, FP, VCSEL, OLED, LED, photodetectors.

Chapter 4 runs to 53 pages because there are at least nine potential uses for metamaterials in 6G in contrast to their minimal use in 5G so this is a large emerging market. They are more compact antennas, THz cable, blocking THz to optical signals for privacy or interference suppression, beam shaping of laser emitters, energy harvesting, 6G reprogrammable intelligent surfaces at optical frequencies (covered in chapters 5 and 6), improving 6G response, reach, device power reduction, increasing power output of photovoltaics powering 6G infrastructure and client devices by a passive overlayer following the sun, increasing power output of photovoltaics by a passive cooling over-layer, other cooling. See 16 manufacturers profiled with their 6G positioning in all of this.

Chapter 5 is "6G reconfigurable intelligent surfaces at 0.3-10THz far infrared" with pages covering materials, economics, materials and device and chapter 6 covers, "6G reconfigurable intelligent surfaces at near infrared and visible light" with 14 pages because these are likely to appear at a later stage and

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are more speculative.

Chapter 7 at 40 pages concerns “Dielectrics, passive optical materials and semiconductors for 6G 0.3THz to visible”. Some were covered in preceding chapters but here we see the big picture and detailed comparisons and likely choices, with reasons and a profusion of latest references for further reading. Why the reduced choice of dielectrics above 0.3THz? What is being done about it? Rational in choosing between thermosets, thermoplastics and inorganic compounds? Liquid crystal polymers? Materials and devices for temperature management of lasers and optical chips? Best phase change and semiconductor material choices for 6G? Winners and losers as we go from 5G to 6G? It is all here in comparison charts and infograms not rambling text.

Chapter 8 concerns important new devices, transformative in 6G performance if successful. It is, “THz cable waveguides for 6G transmission and client device waveguides” complementary to fiber optics in 6G by offering simpler systems. Its 15 pages give needs and likely materials, formats and performance. See silica, sapphire, fluoropolymer, polypropylene and other opportunities and manufacturing options for the first long reels of such cable.

6G will use a huge amount of fiber optics including “deep fiber” going to individual rooms in buildings and fiber underwater. Mostly that will be pre-existing shared fiber made conventionally but there are some aspects that will be peculiar to 6G so we cover fiber optics for 6G systems in the 13 pages of chapter 9 that end with a SWOT appraisal.

Having found that graphene is one of the most popular materials in the optical 6G research pipeline, we end the report with a deeper look without repetition of earlier material. Chapter 10. “Graphene and other 2D materials in 6G”, in 17 pages, surfaces six potential uses in 6G with formats, alternatives, ancillary materials and analysis. The examples cover near and far infrared and visible light frequencies.

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