Telecommunications

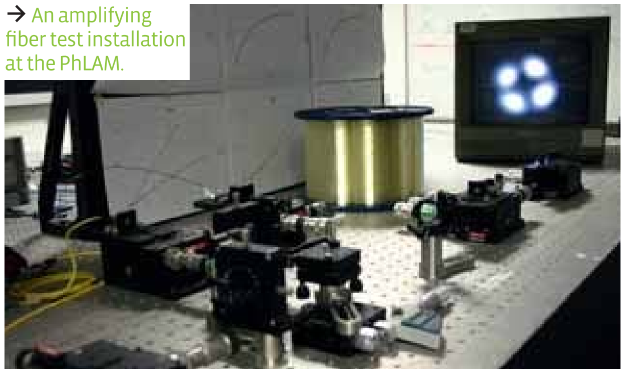
Optical Fibers Gain Momentum

BY JEAN-PHILIPPE BRALY

→ **Since the 1980s, the telecommunications industry has been continually increasing the speed** of data transmission in the form of light via optical fibers. This has been accomplished primarily through bundling more transmission channels on each fiber, either by carrying data on multiple wavelengths, or by modulating the light wave amplitude or phase, for example. As a result, the most powerful systems today can achieve a throughput of 30 terabits per second over more than 6000 kilometers.

"Yet in order to prevent the network saturation expected to occur by 2020, we need to develop even more efficient fibers for long distances," explains Laurent Bigot, from the PhLAM[1] laboratory at the IRCICA[2] Institute in Villeneuve-d'Ascq. With this in mind, PhLAM researchers participated in the STRADE[3] project, whose goal was to find ways to increase throughput using a new type of fiber.

→ An amplifying fiber test installation at the PhLAM.



TERABIT
1 terabit = 10^{12} bits.

Manufactured by the Prysmian Group, these fibers are able to transfer data via different light intensity modes, in other words, using different ways to distribute energy within their core.

One of the main technological feats was finding a way to amplify the light signal so that the system would function over thousands of kilometers. This required the signal to be intensified at regular intervals and equally for each mode. Rising to the challenge, the PhLAM researchers perfected a new type of erbium-doped amplifying fibers that could be connected to the Prysmian fibers. "When erbium ions are placed in a ring around the fiber core and excited with a laser, they become capable of transmitting enough energy to produce the desired amplification in several modes," Bigot explains.

The project demonstrated that up to five light intensity modes could be used simultaneously, thus increasing the throughput five-fold. Alcatel-Lucent is testing the system under actual transmission conditions, with the ambitious goal of reaching a capacity of 150 Tb/s over a few thousand kilometers.

01. Physique des lasers, atomes et molécules (CNRS / Université de Lille-I).
02. Institut de recherche sur les composants pour l'information et la communication avancée.
03. The STRADE project (Slightly multimodal transmission and detection) is a French National Research Agency (ANR) project supervised by Alcatel-Lucent.

CONTACT INFORMATION:
PhLAM, Villeneuve-d'Ascq.
Laurent Bigot
› laurent.bigot@univ-lille1.fr

Lotus Synthesis

Nanodispersion Startup

BY BRETT KRAABEL

→ **Using technology developed at CNRS, the start-up Lotus Synthesis specializes in creating nanodispersions,** which are uniform dispersions of nanoparticles that can be added to chemical coatings to endow them with specific desirable characteristics. Depending on the nanoparticles involved, coatings can be rendered self-cleaning, ultraviolet resistant, scratch resistant, fire resistant, hydrophilic, low friction, and antibacterial, among other properties.

Founded in 2011 by Stéphane Daniele and Arnaud Franck, Lotus Synthesis obtained licenses to exploit two CNRS patents. One of their first products was a self-cleaning coating created from a titanium oxide nanodispersion. When exposed to ultraviolet radiation, the titanium oxide nanoparticles in the coating release electrons, resulting in the destruction of organic molecules on the surface, thus kept clean.

The nanodispersion technology developed by Daniele while at CNRS[1] is based on economical and eco-friendly "soft-chemistry" methods, which require temperatures and pressures routinely obtained when cooking an evening meal. There is therefore no need for exotic technology to control the temperature, pressure, or other parameters in the tank where nanodispersions are made. The process is also *in situ*, since the nanoparticles form in the host liquid, implying that no health-hazardous dry nanopowders will be handled. "The results are of very high quality, scalable, and very reproducible, which facilitates industrial production of nanoparticles," explains Franck. The latter are typically hybrid particles of metal-oxide cores with organic molecules attached to their surface. The organic molecules can be chemically designed as needed, which makes for far fewer incompatibility problems between the nanoparticles and the host liquid medium.

Working with a 10-kg-capacity tank, Lotus Synthesis has already seen its nanodispersions validated by potential clients. The company plans to invest in a 200-kg-capacity tank to meet industrial demand by the end of 2013.

01. Institut de recherches sur la catalyse et l'environnement de Lyon (IRCELYON) (CNRS / Université de Lyon).

ONLINE:
› www.lotus-synthesis.fr

CONTACT INFORMATION:
IRCELYON, Lyon.
Arnaud Franck
› arnaud.franck@lotus-synthesis.fr