CASE STUDY

PPG Ibérica, S.A.

Spain

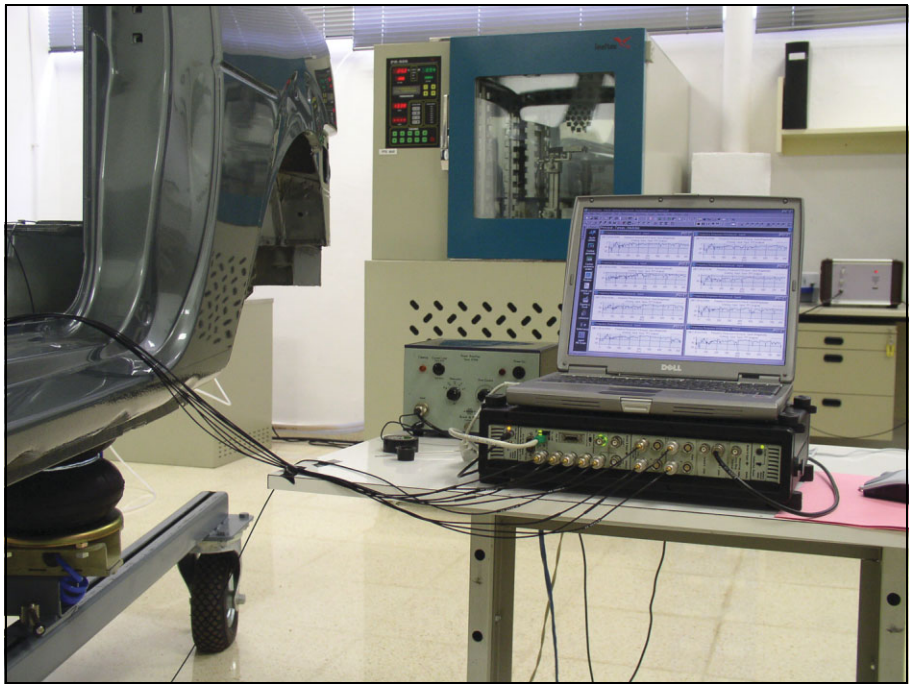
Automotive Applications

NVH Testing

PULSE Multi-analyzer Type 3560

PPG Ibérica, S.A., an equity affiliate of US-based PPG Industries – the world leader in automotive coatings and glass, is a major supplier of coatings for trucks, cars and automobile parts in Europe. As the automotive coatings industry is becoming more specialised, PPG is leading the field with new technologies and total service solutions. PPG Ibérica S.A. is no exception, providing complete NVH testing for OEM customers from around Europe.

One of PPG Industries' latest technologies, Audioguard™, takes traditional coatings to a new level by providing advanced vibration damping for vehicle body structures. NVH testing and benchmarking of Audioguard takes place at the Rubí production and test facilities outside of Barcelona, where Brüel & Kjær products are important components in the measurement process, including a 9-channel PULSE™ system.



Photos Courtesy of PPG Ibérica, S.A.

Quality of Life

PPG Industries has its origins in Pittsburgh, Pennsylvania (USA) as a plate glass producer, starting in 1883. At the end of the 1800s and into the early 1900s, the company began to diversify, acquired a paint company, and by 1902 it was one of the first American manufacturers to set up operations in Europe. As the automotive and building industries grew, PPG's production intensified, stimulating new technologies such as fibreglass and electrodeposition coatings. Today, the company is dedicated to producing a full spectrum of cutting edge materials that improve the quality of life.

With around 170 production facilities, subsidiaries and affiliates around the world and a staff of approximately 34100, PPG Industries' boundaries have grown far beyond its first glass foundry in Pittsburgh. Alone in Spain, PPG Ibérica S.A. has three manufacturing and service sites with over 700 employees focusing on industrial and automotive coatings for customers throughout Europe.

The industrial product line includes coatings for heavy-duty trucks, automotive parts and accessories, etc., while automotive coatings comprise electrocoats, primers, pretreatment chemicals, adhesives, sealants, etc. The company's list of customers includes:

- Audi
- PSA
- Land Rover
- Jaguar
- DaimlerChrysler
- BMW
- Volkswagen
- Fiat

The plant at Rubí is a newly built site, which is responsible for all NVH testing for PPG in Europe.

Innovative Acoustical Coatings

Fig. 1 *PPG Industries' Audioguard Acoustical Coating won an automotive industry PACE Award in 2001*

Audioguard™ Acoustical Coating from PPG Industries, the first liquid paste for vibration damping in the automotive industry, won the prestigious PACE Award for Supplier Product and Process Innovation in 2001. Produced from a specific combination of coated laminar and fibrous material blended with proprietary resin, the mixture is compressed and sprayed by robots onto car body panels. This revolutionary spray application method and resulting hardened film, provides a tough vibration and noise damping material that reduces interior vehicle noise and weighs and costs less than traditional padding methods used on vehicle panels, thus addressing both vehicle manufacturer and end-user needs.

Fig. 2 *A vehicle floor pan with Audioguard applied. The acoustical coating is sprayed onto the panel then allowed to dry. A tough layer is formed, which maintains great damping properties for a quieter ride*

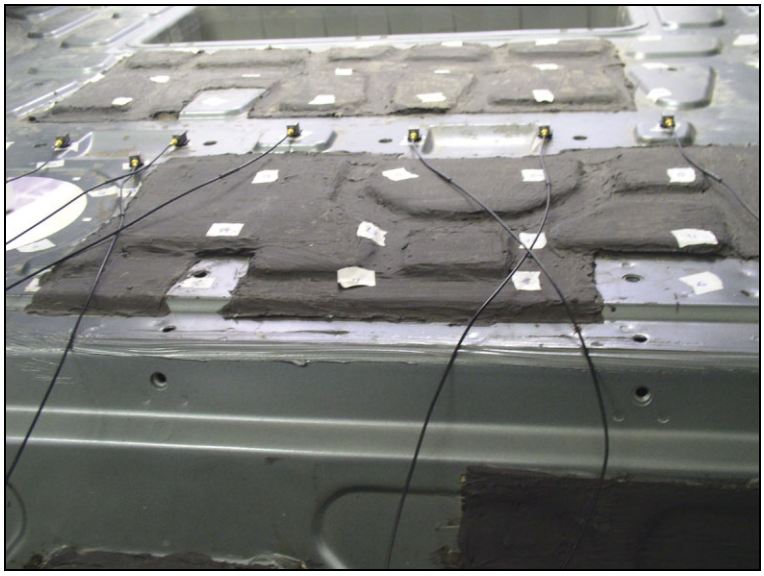


Fig. 3
Enric Martí López, Development Laboratory A & S Europe

Enric Martí López, the NVH test specialist at PPG Ibérica, has been with the company for 20 years. With a degree in chemistry, ten years in Quality Control and ten years in the NVH department, Enric knows both the products and the industry and is responsible for defining the NVH test program. "There is a very big demand for testing now. Everyone wants quieter vehicles and OEMs want comparisons between products. From the tests that we conduct, we can verify that Audioguard provides a combination of cost-effectiveness, easy application and better acoustic properties than other damping methods."

Standard test scenarios involve comparing the Audioguard acoustical coating to conventional damping material found in modern automobiles. Acoustic frequency analysis and vehicle body vibration testing are performed, as well as Oberst bar testing to determine material loss factors.

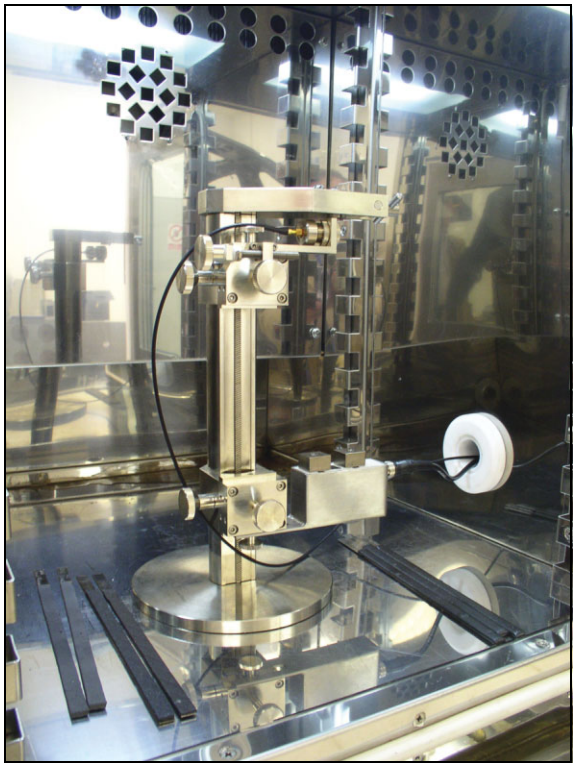


Fig. 4
Oberst bar test method of damping material. The method entails bonding damping material to a vibrating cantilevered steel bar wherein the damping properties are then measured over a range of temperatures and frequencies

Whole body and vehicle panel measurements are carried out with the vehicle's preinstalled padding intact. The padding is then removed and Audioguard is applied. Identical measurements are then performed for analysis and comparison to the previous results. There are about 300 measurement points to cover, which takes roughly 2 to 3 days to complete (not including post-processing), and generates a lot of data for analysis.

Material testing of samples from the padding and PPG's acoustical coating occurs in a climatic chamber, where both temperature and humidity can be controlled. With a temperature range between –40°C to +150°C (–40°F to +302°F) and a humidity as high as 100%, it is possible to determine the damping performance of each type of material under relevant conditions. Enric proudly admits, "We perform Oberst measurements about 30 to 40 times a day using the Signal Analyzer Type 2035 we purchased from Brüel & Kjær nearly 10 years ago!"

Type 2035 is not the only seasoned veteran in PPG Ibérica's NVH test lab. This QS – 9000 and ISO 9001 accredited laboratory has incorporated Brüel & Kjær's sound and vibration analysis instruments as standard equipment throughout its history. On display in the NVH laboratory museum are Brüel & Kjær's Beat Frequency Oscillator, Audio Frequency Spectrometer and Level Recorder, all of which were, at one time, integral tools in PPG Ibérica's NVH test procedures and are still fully functional. "Our relationship with Brüel & Kjær goes back 35 years," states Enric, "and we have always been satisfied with Brüel & Kjær's products, excellent service and support. Today, our measurement setups are built around current Brüel & Kjær solutions, including: Power Amplifier Type 2706, Small Vibration Exciter Type 4809, and our most recent acquisitions: PULSE Multi-analyzer Type 3560, FFT & CPB Analysis Type 7700, ME'scopeVES™ Test Consultant Type 7754 and a number of Type 4507 piezoelectric accelerometers."

Fig. 5
Just some of the Brüel & Kjær equipment used at the PPG Ibérica NVH test lab
Right: *The past: Beat Frequency Oscillator Type 1022, Audio Frequency Spectrometer Type 2112 and Level Recorder Type 2305*
Left: *The present: Small Vibration Exciter Type 4809*

Test Methodology

In the lab, the test vehicle is positioned on a test stand and buffered by 4 sets of rubber isolation mountings. The vehicle's standard damping material is kept in place while the body is fitted with accelerometers at strategic points to measure vibration effects. To simulate the affects of normal vibration on a vehicle, Power Amplifier Type 2706 amplifies a white noise signal generated by the 9-channel PULSE front-end, which, in turn, drives Small Vibration Exciter Type 4809.

Measurements are made using PULSE's FFT analyzer in the 0 to 800 Hz frequency range, with values at 200 Hz being the most crucial. These measurements are saved on the PC's hard drive and copied over to CD as backup. The accelerometers are then moved to the next measurement points (about 300 in all). Once this process is complete, the padding is removed, Audioguard is applied and the whole measurement process is repeated.

Analysis

The raw data gathered during the 2 or 3 days of measuring, takes about a day to post-process. One of the more dynamic analysis tools involves ME'scopeVES™ Test Consultant Type 7754, wherein imported data from third parties are correlated with PPG's own data and displayed as 3D animation. From the animation, it is possible to compare the effects of Audioguard on a structure's dynamic behaviour in relation to a competitor's product.

Reports are generated using a PULSE template and exported to Microsoft® Excel or Word, and/or simply cut and paste.

Easy to Use and Understand

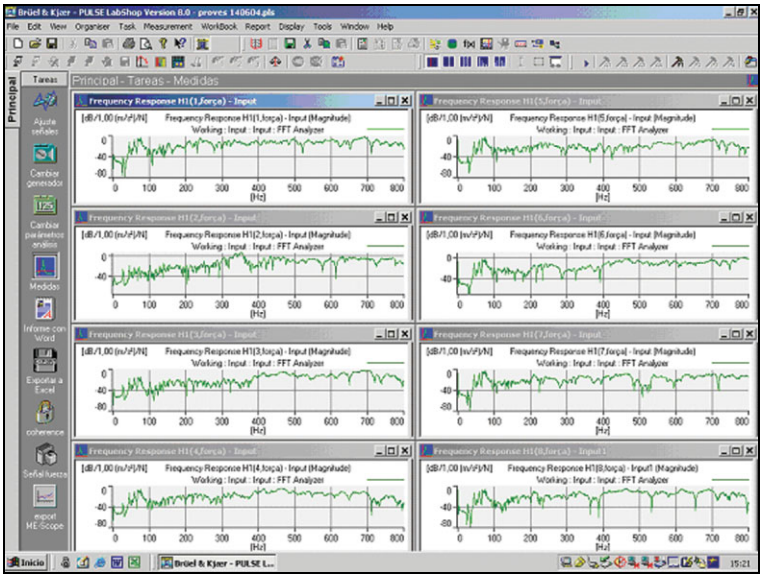


Fig. 6
Typical PULSE display of a measurement from a whole body test

PPG Ibérica purchased its first PULSE system early in 2004 and already Enric can see improvements in the lab's test methods. "The PULSE concept has improved the way we measure and post-process data, including quickly implementing PULSE's built-in import and export functions

With the PULSE modular structure, we can execute various applications and expand our measurement capabilities using just one system. Additionally, the built-in TEDS facility makes it is easy to set up measurements with fewer chances for errors".

Enric has also taken advantage of the course offerings arranged by Brüel & Kjær University in Nærum and attended both the PULSE 7700 Software and Modal Analysis courses. According to Enric, "Once you learn the basics, it is quite easy to use and understand". Value-added services such as the University courses and customer support provided through Brüel & Kjær Ibérica, S.A., has made it possible for Enric to make the most of the new PULSE system.

Future Installations

Enric does not plan to stop here. "Currently, we must move the accelerometers about 40 times during a whole body test – for each individual product tested in a measurement sequence. This can be rather labour-intensive and time-consuming. Our plans are to increase our PULSE system to 16 or 21 channels thus saving us both measurement time and work. Moreover, with the addition of PULSE Data Manager Type 7767, we will be able to store the massive amount of data generated during testing and facilitate easier data comparisons".

But that's not all for PPG Ibérica. As a total service solutions provider, the NVH test lab has to be open to industry quality and test demands. "We are in the planning stages of building both an anechoic and reverberation chamber for acoustic measurements," says Enric. "We already have customers asking for these services, and our system, complete with Brüel & Kjær products, is prepared to handle the challenge".

Key Facts

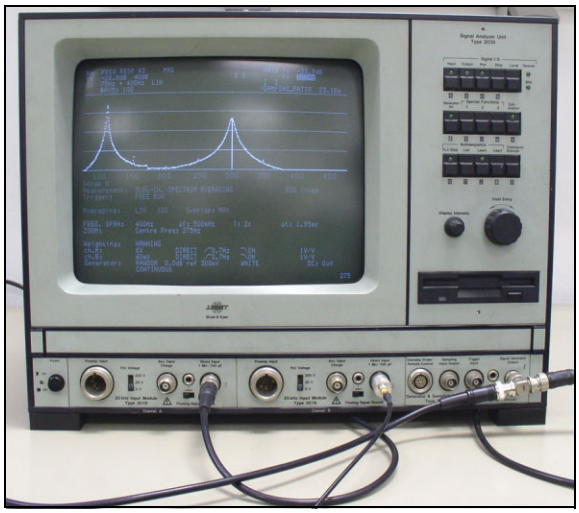


Fig. 7
Signal Analyzer Type 2035 in use (spectrum analysis) at the PPG Ibérica NVH test laboratory in Rubí, Spain

- PPG Ibérica S.A. is an equity affiliate of PPG Industries, a US-based glass, coatings and chemical manufacturing giant. PPG Industries is the world leader in automotive coating production, with an emphasis on technologically advanced coating materials and innovative production and application methods
- One of PPG's most recent innovations is Audioguard™, an award-winning sprayable vibration damping coating for automotive body structures. Audioguard reduces noise and vibration within car interiors. It also reduces weight and costs for auto manufacturers when compared to traditional automotive damping material and application methods
- PPG Ibérica produces and tests coatings for automobile and industrial manufacturers throughout Europe. It has three production sites in Spain. The Rubí facility outside of Barcelona, is responsible for NVH testing for all PPG affiliates in Europe
- PPG Ibérica has been a loyal customer of Brüel & Kjær for over 35 years. "We have always been satisfied with Brüel & Kjær's products, excellent service and support"
- Signal Analyzer Type 2035 is used about 30 to 40 times a day to conduct Oberst Bar tests of damping material in a temperature and humidity controlled climatic chamber
- In the spring of 2004, PPG Ibérica purchased a 9-channel PULSE system, several Type 4507 piezoelectric accelerometers and ME'scopeVES™ Test Consultant Type 7754
- The TEDS facilities in PULSE and the accelerometers, as well as PULSE's report functions have greatly improved PPG's testing methods. The ME'scopeVES license provided PPG with a tool to import and overlay 3rd party data for comparative analysis with their own product data. Data displays are then animated for unique views into the products' effects on vehicle structural dynamics
- Enric Martí López, the NVH test specialist at the Rubí facility, has attended PULSE-related courses offered by Brüel & Kjær to make the most of their new equipment
- There are plans to expand the current PULSE system to 16 or 21 channels to accommodate multi-point measurements, and build anechoic and reverberation chambers for acoustic measurements

BA 0709 – 11 05/01

HEADQUARTERS: DK-2850 Nærum · Denmark · Telephone: +45 4580 0500
Fax: +45 4580 1405 · www.bksv.com · info@bksv.com

Australia (+61) 2 9889-8888 · Austria (+43) 1 865 74 00 · Brazil (+55) 11 5188-8166
Canada (+1) 514 695-8225 · China (+86) 10 680 29906 · Czech Republic (+420) 2 6702 1100
Finland (+358) 9-755 950 · France (+33) 1 69 90 71 00 · Germany (+49) 421 17 87 0
Hong Kong (+852) 2548 7486 · Hungary (+36) 1 215 83 05 · Ireland (+353) 1 807 4083
Italy (+39) 0257 68061 · Japan (+81) 3 5715 1612 · Republic of Korea (+82) 2 3473 0605
Netherlands (+31) 318 55 9290 · Norway (+47) 66 77 11 55 · Poland (+48) 22 816 75 56
Portugal (+351) 21 416 9040 · Singapore (+65) 377 4512 · Slovak Republic (+421) 2 5 443 0701
Spain (+34) 91 659 0820 · Sweden (+46) 8 449 8600 · Switzerland (+41) 44 8807 035
Taiwan (+886) 2 2502 7255 · United Kingdom (+44) 14 38 739 000 · USA (+1) 800 332 2040

Local representatives and service organisations worldwide

Brüel & Kjær