

White Paper

Vibration Isolation for Cell Culture Incubators

Cell culturing is a common technique used in biology to carefully grow a specific type of cell. Great care is taken to maintain sterile conditions when preparing cell cultures. They are typically prepared in a sterile, vented hood with materials that have all been disinfected before use. Cell cultures are then carefully placed in an incubator to maintain a sterile and controlled environment for optimum cell growth. For instance, mammalian cells are typically cultured in a CO₂ incubator at a temperature of 37 degrees C, very high humidity, and a CO₂ level of 5-7%. These conditions mimic those found in the body.

But is that all you need to worry about? Recently it has been found that unwanted vibration can play a deleterious role in cell culture incubators. Vibration can come from the incubator itself, due to fans or circulation of water to heat the incubator. More often vibration comes from the environment.

These types of vibration problems have been well known in the semiconductor, photonics, and microscopy industries for more than 50 years. For that reason, equipment suppliers in these industries typically will have a vibration specification for the facility into which their products will be installed. This is not the case for incubators, though it probably should be.



Figure 1. Vibration-induced concentric ring pattern in a 100mm dish containing chick embryo fibroblasts that was stained 1 hour after plating.

Some incubator manufacturers are beginning to understand the issues that vibration can cause. "Incubator vibration is responsible for some of the most bizarre growth patterns that occur in culture vessels. Its effect primarily occurs on cells when they are trying to initially attach to the surface following inoculation of the vessel. In dishes, vibration will push cells to the edges or middle of the vessel or will sometimes form concentric rings of cells. Figure 1 shows this type of pattern in a chick embryo fibroblast culture."¹

Here is another example from a different incubator manufacturer. "A typical example of standing waves in a cell culture flask is shown in Figure 2. In this case, the standing waves have been formed across the flask.

How to eliminate the problem?

Eliminating vibrations may not always be possible due to the construction of the fan or placement of the fan motor. Since the problem of vibration is essentially due to resonance in frequency, you can try to alter the frequency of your equipment (e.g., incubator) by, for example, placing something heavy in one corner of the incubator; but be aware of the risk of potential contamination in the incubator and be prepared to take necessary measures to minimize the risk."²

While these are good tips for minimizing the influence of vibration, there is a better way to deal with vibration problems in the lab, that is to isolate the entire incubator from unwanted vibration by placing it on an anti-vibration platform like the MaxDamp®.

In a typical cell culture lab, vibrations can come from a number of sources. Aside from the incubator fan, they can come from a centrifuge placed next to the incubator, a freezer or refrigerator turning on and off, and even from the climate control system in the cell culture lab.



Figure 2 Cell culture growth in a flask when standing waves are present.

In this case two incubators were stacked on top of each other and placed on our MaxDamp vibration isolation platform. MaxDamp uses our Gimbal Piston air isolator legs to minimize the transmission of floor vibration caused by other instruments. For example, if a centrifuge were running nearby the incubators, the vibration from the centrifuge could be transmitted to the incubators causing these vibration patterns we see in the cell cultures. With the incubators on the MaxDamp platforms they are relatively unaffected by vibration from centrifuges, foot traffic, HVAC systems or other vibration sources commonly found in life science facilities.

Don't take risks with your valuable cell cultures. Protect your incubators from unwanted vibration sources with vibration isolation solutions custom tailored to your application.



Figure 3 Incubators stacked on TMC MaxDamp vibration isolation platforms

1. Ryan, John A. "A Guide for Identifying and Correcting Common Cell Growth Problems with Adherent Cells." We Get You, www.corning.com/worldwide/en/products/life-sciences/resources/webforms/we-get-you-a-guide-for-identifying-and-correcting-common-cell-growth-problems-with-adherent-cells.html.

2. Vibration Patterns in Cell Culture Vessels, 2018, assets.thermofisher.com/TFS-Assets/BID/Technical-Notes/vibration-patterns-cell-culture-vessels-technical-note.pdf.

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