Nondestructive inspections currently play, and will continue to play, a critical role in the manufacturing of composite materials by identifying parts that pass/fail quality targets at the end of the production line. However, there is an urgent need for a paradigm shift to enable high volume composite manufacturing by supplementing end-of-line NDE tools with in-line NDE technologies to inform process decision making. This new approach has the potential to significantly reduce scrap and increase throughput while reducing part variation. The key to in-line NDE is to harness process dynamics by exploiting measurement signatures for diagnosing changes in the material state including deviations or flaws in the material. This talk will discuss case studies in which process signatures in the manufacture of composites are monitored for the purpose of in-line NDE to inform the process. Case studies will focus on carbon fiber manufacturing whereby NDE is used during the process to identify tow form and flaws including broken filaments.